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Understanding the World Food System

Its Importance to Illinois and the Nation

Proceedings of a Conference
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Understanding the **World** Food System

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Proceedings of a Conference
at the University of Illinois
Urbana-Champaign
February 14-15, 1982



International Agriculture Publications
General Series Number 1

College of Agriculture
University of Illinois
at Urbana-Champaign

October, 1982

Single copies of this publication may be obtained from the following address:

Office of International Agriculture
University of Illinois at Urbana-Champaign
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Foreword

These proceedings contain papers given at a special conference on the world food system which was held at the University of Illinois at Urbana-Champaign (UIUC) on February 14 and 15, 1982. The purpose of the conference was to deepen our understanding of the complex nature of the world system and of how that system affects consumers, American farmers, and businesses that are involved in producing and marketing U.S. food products and farm input supplies. The conference focused on the role of the United States and Illinois in meeting world food needs while at the same time maintaining a strong food and agricultural sector in the U.S. economy.

The conference provided a forum for the presentation of facts and ideas by authorities on the world food situation, as well as an opportunity for an exchange of views by those attending. The panel presentations and question-and-answer sessions that followed each major segment of the program allowed for participation by individuals from a wide range of interests and professions. The over 250 persons who participated represented farming enterprises, agribusiness firms, colleges and universities, social action groups, and national and international development agencies.

The opening presentations and discussions dealt with the ability of the United States to meet the needs of a rapidly expanding world population, many segments of which face persistent malnutrition and starvation. A presentation on the need for a long-term U.S. food policy served as the background for presentations on the agricultural needs and developments of low-income developing countries, middle-income countries, and higher-income industrialized countries. A summary paper focused on the implications of these issues for Illinois. The program then called for consideration of the U.S. government's role in developing a world food strategy, and panel discussions on strategies for solving short-term and long-term world food problems followed. The perspectives of the farmer, food processor, and input supplier were all represented in these discussions.

These proceedings include papers presented by several of the conference speakers. They are intended for those who participated in the conference, as well as for others who are concerned with the problems just described.

Financial and staff support for the conference were provided by the UIUC Office of International Programs and Studies; the College of Agriculture's Office of International Agriculture; and Continuing Education in International Affairs, a unit of the Office of Continuing Education and Public Service. Deere & Company made a financial contribution to the University of Illinois for this program.

The members of the conference planning committee were M. Dale Bateman, University of Illinois Cooperative Extension Service (Douglas County), Tuscola; F. Wayne Baughman, Illinois Agricultural Association, Bloomington; George K. Brinegar, director, Office of International Programs and Studies, UIUC; William Fugate, farmer, Fairbury; Roy E. Harrington, Deere & Company, Moline; Earl D. Kellogg, associate director, Office of International Agriculture, UIUC; Lyle G. Reeser, Caterpillar Tractor Company, Peoria; Nancy A. Risser, former assistant vice chancellor for research and assistant dean, Graduate College, UIUC (presently director of community relations, Office of the Vice President for Public Affairs, CBS, Inc., New York, New York); Willard Severns, farmer, Moweaqua; James M. Spata, Ralston Purina Company, St. Louis, Missouri; and William N. Thompson, director, Office of International Agriculture, UIUC. The committee was chaired by J. Terry Iversen, head, Continuing Education in International Affairs, UIUC.

The Office of Continuing Education and Public Service and the Office of International Agriculture, UIUC, are pleased to make these proceedings available to those who have a continuing interest in world food systems and their relevance to Illinois and the United States. Our appreciation is expressed to Dorothy Rosen and Susan Zorn, Office of Agricultural Publications, and to Carolyn Evans, Office of Agricultural Communications, who assisted in editing and producing this publication.

W.N. Thompson, Director
Office of International Agriculture
College of Agriculture

J. Terry Iversen, Head
Continuing Education in
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Office of Continuing Education
and Public Service

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The Changing World Food System

Our Challenges and Opportunities: Title XII*

The Honorable Paul Findley

About this time one year ago, I was participating in a House Foreign Affairs Committee hearing to review U.S. aid to Egypt. The hearing focused, in particular, on American economic assistance for Egypt. This amounted to \$750 million in fiscal year 1981 alone and over \$4 billion during the previous five years. And these figures do not include the more than \$1 billion in Public Law 480 food aid we have provided to Egypt in the recent past. Despite the well-known Congressional allergies to foreign aid, members of the Foreign Affairs Committee have supported our assistance program for Egypt. Members recognize the political importance of that country and its pressing development needs.

But Congressional frustration was running high at this hearing. In March 1981, the U.S. economic assistance pipeline of unexpended funds in Egypt was \$2.4 billion. So, well over half of the funds Congress had appropriated in previous fiscal years had not been spent. Members felt we were getting the worst of all possible worlds. We had in Egypt a very costly program that was neither promoting economic development nor winning friends within the Egyptian population. Moreover, upon examination, our aid projects in Egypt appeared scattered over many sectors of the population and economy without a clear connecting thread. Too many projects appeared not designed to have a lasting impact. We planned to build a facility, train some people, and then move on to new undertakings. What was lacking was a provision for institution-building within Egypt that could provide an indigenous capacity for problem solving. And we appeared to be failing to conceive of long-term linkages with U.S. institutions that could help with follow-up training, counsel, and people-to-people contacts down the road. These problems have plagued our aid efforts elsewhere. When the U.S. departed, our projects withered. We left behind no institutional capacity that enabled the peoples concerned to solve their own problems without constant outside intervention and supervision.

*Title XII of the International Development and Food Assistance Act of 1975 provided that "the United States should strengthen the capacities of the United States land-grant and other eligible universities in program-related agricultural institutional development and research, should improve their participation in the United States Government's international efforts to apply more effective agricultural sciences to the goal of increasing world food production, and in general should provide increased and longer term support to the application of science to solving food and nutrition problems of the developing countries."

Paul Findley: Member, U.S. House of Representatives, Illinois Twentieth District.

In Egypt, this lack of an Agency for International Development (AID) strategy appeared particularly acute in the agricultural sector. A General Accounting Office report that was released the same day as the Committee hearing pointed out that AID had not developed a strategy for extending new technology to farmers in order to assure that program benefits reached small farmers. We had not helped the Egyptians to establish linkages between research and extension services to transfer technology to the ultimate user--the farmer.

Yet, this type of institution-building is the key to promoting agricultural development and enhancing the dignity of the small farmer and his family in the Third World.

This key is the idea behind Title XII which Senator Hubert Humphrey and I put into the foreign aid legislation in 1975. In practice, not all of our original objectives have been fulfilled. But I believe that Title XII is more vigorous than ever and that some of the constraints to its greater effectiveness are perhaps in the process of being eliminated.

Title XII recognized that an agricultural extension service to transfer expertise and technology to the small farmer in the Third World is critical to agricultural development there. We all understand the importance of research into new methods of agricultural production; but unless this research is used in the field, it does not lead to increased production. The best agricultural expertise in the United States has long been found in our land-grant universities with their distinguished faculties, established reputations in research, and effective outreach programs to transfer the latest technology and know-how to the American farmer. The remarkable success of U.S. farming stems largely from the extension work of our land-grant universities.

Title XII, however, does not seek to transplant American institutions or practices to nations in Africa, the Middle East, or elsewhere. Instead, the objective is to establish a long-term, close-knit relationship between a single U.S. land-grant university and a Third World Nation to develop within the latter the capability to define and solve its own agricultural problems. This process begins by the undertaking of a baseline study or assessment of the full range of problems and prospects of the agricultural sector within that nation.

Since the Committee hearing on Egypt last year, AID has become more aware of the importance of Title XII and agricultural extension in Egypt. While AID had involved U.S. land-grant universities in specific projects, such as a major cereals project and a rice research and training project, AID had no strategy for forging an overall program in Egypt. The approach was piecemeal because it was crop-specific and did not address the overall problem of establishing an extension service encompassing local as well as national government bodies in Egypt.

But since March 1981 and the cumulative impact of the hearing and the GAO report, AID has begun to move forward on the right track. First, it sent to Egypt a team of experts from within AID and from certain land-grant universities to assess Egypt's need for agricultural extension. The team was headed by E. T. York of the University of Florida and Elmer Kiehl, Executive Director of the Board for International Food and Agricultural Development (BIFAD). The Egyptian Government, which was also impressed by the GAO report and the hearing, worked closely with the York team. The result is an excellent study on how to organize agricultural extension in Egypt. And this report is not now lying on a shelf; it is in

the process of implementation. Further teams are now enroute to Egypt to examine how best to set up programs for training extension agents and to offer advice on organization problems. These teams are comprised of extension specialists from Michigan State University. And the Egyptian Government has also asked E. T. York to return to do a full-scale agricultural sector study and develop a strategy for increasing production. The study will include an examination of existing government pricing policy and both incentives and disincentives. Dr. York's co-leader on this visit will be Jack Claar, Associate Vice-President of the University of Illinois and former Director of the Illinois Cooperative Extension Service, an outstanding choice for this task.

It is noteworthy that the Egyptian Government specified that this study be headed by Dr. York and not by the U.S. Department of Agriculture, which had done a sector study for Egypt in 1976. Aside from respecting the expertise of Dr. York and his land-grant university colleagues, the Egyptians find strategy and advice from non-U.S. Government experts more acceptable. They regard the ideas of these experts as objective and impartial, rather than part of an official U.S. effort to force them into taking certain steps which they may find objectionable.

And these new endeavors by Dr. York and his colleagues, and your colleague from the University of Illinois, will build upon previous work done in Egypt by the land-grant universities. The increases in yields of 60% or better in the major cereals projects are demonstrating that the experts in the land-grant universities know their stuff and, in cooperation with colleagues in Egypt, can produce dramatic results. Now, however, the various projects under way can be integrated into a broad strategy for Egyptian agricultural development and can be linked into an agricultural extension service in Egypt.

This case study of Egypt and the efforts of the Committee on Foreign Affairs, the Agency for International Development, and the land-grant universities is important to our understanding of what needs to be done elsewhere. As our largest aid program, what occurs in Egypt is bound to have an impact on thinking in Washington on how best to assist the developing world.

The Agency for International Development may now be moving in the right direction in some other areas that affect Title XII and the land-grant universities. AID's past reluctance to make multi-year commitments to universities on Title XII projects has complicated the university planning process and made a far-reaching agricultural strategy more difficult. In the past few months, however, AID has signed three new memoranda of understanding with universities that are all five-year agreements. I hope these are harbingers of increased AID willingness to make longer-term commitments to both the land-grant universities and the developing nations.

AID is also computerizing its research to gain a better grasp of what work has been done and what needs to be done. This knowledge will certainly be more useful to the developing nations, which need new technology and expertise immediately.

And AID is moving ahead with a program which is one of the most exciting innovations of Title XII. This is the Collaborative Research Support Program, or CRSP. Rather than being a traditional research effort, the CRSP involves U.S. land-grant universities in solving constraints on food production and improving food utilization right in the less developed nations. As part of the CRSP, short-term

training courses and workshops are conducted in the Third World nations participating, while individuals from those countries come to the United States for seminars and for longer-term university training to enhance their skills. One example is the Small Ruminants CRSP under way in Peru, Brazil, Indonesia, Kenya, and Morocco, with teams from thirteen U.S. universities. Animal breeding, nutrition, health, range management, economics, and sociology are aspects of the CRSP. Since 40% of the world's sheep and 77% of the world's goats are in the Third World, information on feed supply, disease, and parasitism is particularly important to the small farmers who own these herds. Since demand for these small animals exceeds supply, improving their production would improve the diets and living levels of millions of Third World citizens. Higher incomes, in turn, would increase the demand for other agricultural products. For example, most of our Illinois soybean crop is now exported to the more developed nations. Helping the small farmer abroad to increase his agricultural production would in no way undercut U.S. agricultural export markets. Such help actually increases our exports by elevating the level of living in Third World nations and their ability to import U.S. foodstuffs and grains.

Moreover, this CRSP is an undertaking to which the American universities involved, as well as the developing nations and the U.S. Government, contribute financially and from which all parties profit in return. For example, in providing U.S. agricultural experts with hands-on experience with Third World livestock, the Small Ruminants CRSP will have important benefits for the U.S. livestock industry. It is important to remember that breeds of sheep found in the Third World are among the most prolific and could, therefore, be used to increase U.S. production.

In closing, I would like to state that I am very much encouraged by the commitment made by President Reagan at Cancun to stimulate the transfer of U.S. agricultural expertise to the Third World. His initiative will, I believe, build upon Title XII by stressing the importance of beginning the U.S. assistance role with an analysis of the national agricultural sector and then by stressing the importance of technology transfer and training.

In brief, Title XII promotes long-term linkages for research and development of benefit both to the Third World nations and to our own agricultural producers. It raises the standard of living for the small farmer in the developing world and consequently improves the markets for our own agricultural goods. It is technology transfer and training of the best kind, since it institutes a long-term, problem-solving capability in the Third World which is important to us all and particularly to us here in Illinois, a great agricultural state.

The Need for a Long-Term U.S. Food Policy

Lauren Soth

Since the presidential election of 1980 we've been listening to an increasing volume of talk about national security and appropriate U.S. strategy in a turbulent world. The strategists are concerned mainly about military balances of power, asserting that we have slipped dangerously behind our potential adversary. I shall argue for another kind of strategy, which I believe is more crucial to the security of the United States and of the world than military strategy--namely, the strategy of food and agriculture. Relieving hunger and malnutrition seems to me an essential short-term as well as long-term strategy for reducing tensions and the causes of war. The relief of hunger is the best foundation for attacking poverty and inequality, the underlying causes of unrest, revolution, and war in the world.

Our present food and agriculture policies at home and abroad lean heavily on exports of grain. We seem to be working on a plan to supply the growing demand of the world for food from our own resources. This plan, I shall argue, is shortsighted and even dangerous. It is based on looking backward at food and agriculture in this country.

Mark Twain wrote an essay on "Corn-Pone Opinions", quoting a friend of his youth as follows: "You tell me whar a man gets his corn pone en I'll tell you what his 'pinions is." He meant that most of us conform to local, regional, factional, or organizational opinion rather than thinking things through for ourselves. The opinions of the people writing one's paycheck also possess great persuasive power.

John Kenneth Galbraith invented the expression "conventional wisdom" to describe a similar human propensity: hanging onto outworn political ideas beyond their usefulness and in disregard of changing facts.

I'd like to say a few words about the conventional wisdom (or corn-pone opinion) on agricultural policy, specifically about grain export policy.

Conventional wisdom relies on slogans, advertising, stereotypes, and other substitutes for thought. This wisdom (or corn-pone opinion) often is founded on solid rock--a rational solution of a problem at the time it was created. The Greenbackers and the silverites of the 1870s and 1880s wanted to expand the money supply in order to cheapen the dollar, raise prices of agricultural products, and stimulate exports. They were as single-minded about money as the monetarists of today. They wanted to monetize silver on a ratio of

Lauren Soth: Columnist on Food and Agriculture, The Register and Tribune Syndicate, Des Moines, Iowa.

16 to 1 with gold; they called the deflationary resumption of gold payments for the greenbacks after the Civil War the "crime of '73." The 16 to 1 formula became a political slogan. This conventional wisdom lasted into the 1890s, when farm prices had begun to rise and exports were growing. William Jennings Bryan's eloquent appeal in '96 not to crucify the farmer on a cross of gold was a bit late.

After World War I farm politicians became infatuated with another ratio--between the prices of farm products and the prices of things farmers buy. Index numbers aggregating a whole list of prices were new and fashionable. The deflation of farm prices and the loss of export markets in the 1920s made the price-ratio theme popular. Equality for agriculture was the rallying cry. The Department of Agriculture and the state ag colleges came up with ratios showing the farmer's disadvantage in the marketplace, thus setting the stage for the parity symbol which became an actual legal yardstick for government price supports in the 1930s. The parity ratio has outlasted the 16 to 1 silverite ratio as a piece of conventional wisdom.

The favorite piece of conventional wisdom in the food and agriculture business lately has been the inequity of grain-export embargoes. Farmers and business executives who, 20 years ago, held that trading with Communists was unthinkable have now decided that any governmental interference with their right to sell as much grain as they can to the Soviet Union is what is really unthinkable--and un-American besides. The brief embargoes on exports of grain and soybeans by Presidents Nixon and Ford take their place with "the crime of '73" a hundred years earlier as political crimes unforgivable. Jimmy Carter compounded the evil; he promised never to let the word embargo cross his lips and then did it--to punish the Russians for invading Afghanistan. President Reagan has largely escaped the wrath of the anti-embargo forces. He promised during the 1980 campaign to lift the embargo and then lifted it. The conventional wisdom of anti-embargoism proved to be stronger than the fierce anti-Sovietism which the Reaganites proclaim.

In practice, the embargo didn't work to punish the Russians; it made America look ineffectual in the attempt. By the same token, it did not hurt U.S. agriculture. Grain prices were considerably higher in 1980 and 1981 than before the embargo, even though the corn, wheat, and soybean harvests all set records in 1979. The 1980 corn and soybean crops were not so good, but wheat set another record. The slump in prices for a couple of months following the embargo could well be attributed to huge supplies and the conventional wisdom that the embargo would cut exports; this belief soon turned out to be wrong. Exports of grain for the 1979 and 1980 crops were larger than ever and now promise to be only marginally, if any, lower this year. Lifting the embargo, like the installing of it, appears to be only a minor factor in total grain exports.

American agriculture was built on foreign trade; from colonial times to the present, exports have been important. So it is understandable that arbitrary interference with trade sends spasms of alarm through the farm and agribusiness community. Thomas Jefferson's Embargo Act of 1807 was a disaster for the infant U.S. economy. Jefferson wanted to stop the British seizures of our ships carrying food to the French, and to keep France from blocking our ships of food to Britain. Congress agreed. Despite the depredations of the combatants, America was prospering mightily from selling

to both sides. But national pride superseded economics. After 1807 commerce dwindled. It wasn't until after the War of 1812 and the downfall of Napoleon that freedom of the seas permitted foreign trade to flourish.

The ardor of American farm leaders for exports is understandable. Throughout history, a decline in export business has meant surpluses and low prices for farmers; after World War I, the farm depression was attributed largely to a fall-off of exports.

In 1934 Henry A. Wallace, who had just installed a crop-acreage reduction plan, wrote a pamphlet called "America Must Choose." It was very influential and had much to do with the passage of the Reciprocal Trade Agreements Act. Wallace said in his pamphlet that America had a choice between continued and probably more severe restraints on farm production, possibly with compulsion, or the opening of trade to sell farm surpluses abroad. The latter choice, which he favored, would require lower tariffs and efforts to increase imports to receive payment on foreign debts and to finance an expanding export trade. "There is world trade to be had," he said. "By paying the price the United States can get its share. What is that price? It must buy abroad as well as sell abroad." Although some industries would be hurt, and have to adjust, Wallace argued that the nation's prosperity would be enhanced in the long run. The auto manufacturers thought that was great stuff. But times change.

After World War II one of the principal cures for farm surpluses was to expand foreign sales--by subsidy and by promotion. Public Law 480, the famous Food for Peace Act, came about not just because of the generosity of the American people to help relieve hunger abroad, but primarily to get rid of surpluses. The entry of the Soviet Union into the world grain market in a big way in 1972 was seen as a bonanza by agriculture officials and farmers. It was a way to avoid crop acreage controls.

During the last decade, however, we have learned that the buying of the Russians and other new grain customers carries heavy risk. Rising income in the developing countries and in the industrial world has swollen the demand for grain to produce meat, milk, poultry, and eggs. This demand has increased American farmers' incomes; but it has also exposed them to greater uncertainty. The Russians buy from us only when their own crops are short. Their irregular buying has caused large fluctuations in prices, harmful to U.S. livestock producers and to consumers. The Ford Administration attempted to introduce stability into this trade by the agreement with Russia of 1976, setting a minimum of 6 million and a maximum of 8 million tons of grain. The Carter embargo applied only to exports above 8 million. The 1976 agreement was for five years, but it was extended for another year and will end next September.

The boom in grain exports has placed stress on soil and water resources from increasing specialization in grain and soybean production. Large-scale one- and two-crop farming, especially of intertilled crops such as corn and soybeans, speeds up water and wind erosion. Topsoil losses have increased substantially in Iowa, Illinois, Indiana, west Tennessee, southern Minnesota, and Missouri. Topsoil is renewable, but at geologic rates. For practical purposes it must be considered a finite resource, like petroleum.

The Soil Conservation Service in 1977 conducted a detailed inventory and assessment of the nation's soils. It found that erosion is taking place on much of the best cropland at a faster rate than the soil can be replaced. Topsoil lost by erosion is slowly rebuilt by weathering of the subsoil, and the process can be speeded by cultivation and additions of large amounts of nutrients and organic matter. SCS has assigned soil-loss tolerances for different types of land--how much can be lost considering the rebuilding rate. These tolerances never exceed five tons per acre per year. In the Corn Belt, about one-fifth of the land is eroding at the rate of 10 tons per acre per year, double the tolerance limit. Iowa is losing topsoil at an average rate of 10 tons, the highest average soil loss of any state. Five tons per acre per year is about half an inch in 15 years. Some soil experts have said that Iowa has lost half its topsoil in the last century. Most of that loss has probably occurred since World War II.

Exports are not the only villain in the soil-loss drama. It would not have been possible to plant all that land to grain and soybeans and keep it in those crops year after year without the new chemicals for weeds and insects and the synthetic fertilizers to replace soil nutrients. But the chemicals couldn't replace the topsoil. Nobody thought much about that at the time--just a few soil scientists, conservationists, and environmentalists. The latter were in ill repute among farmers, who thought their proposed restrictions on chemicals and on stream pollution were a handicap. The farmers probably listened too closely to the chemical manufacturers and their propagandists, as well as the grain companies--all of whom, of course, wanted grain acreage and production to increase as rapidly as possible.

With increasing farm size and specialization, we've lost the natural soil-conservation system within agriculture, livestock and crop rotations along with the grain. As agricultural economists have been pointing out for a long time, the weight of government activity and policy--price supports, acreage adjustments, and everything else (including land-grant university research and education)--has been on the side of expanding farm size and specialization in grain. Grain farmers have had an advantage over the years, not by the hand of God or the so-called free market, but by government programs. Such programs can be changed if people want to do it, that is, to remove the advantages of specialization and make diversified farming, which tends to be more conserving of resources, more feasible economically.

Removing from crop production hilly land and other land that is subject to severe erosion is by far the most effective way to reduce topsoil losses. We spend a great deal of money and technical manpower on devising methods of holding soil in place that would be better spent in getting farmers to quit planting land to corn and soybeans that ought to be in permanent pasture or trees.

The 1977 National Resources Inventory indicated that the erosion problem is concentrated in a small portion of the farmland. About two-thirds of the cultivated land would erode at rates below the 5-tons-per-acre average tolerance, even without special conservation practices. Erosion would be extremely severe on about 5 percent of the land--perhaps over 25 tons per acre. Moderate to severe erosion would take place on nearly a third of the cropland.

For reasons other than using food as a weapon in international politics, therefore, we may find in the near future that some extra-market controls over exports of grain are necessary. Don't use the bad name of embargo, but call it prudent husbanding of resources for sustained, longtime production. The Saudi Arabians are becoming concerned about depleting their oil reserves through headlong exporting to meet world demand. The same concern may rise in the U.S. about grain-producing resources here.

Integration of U.S. agriculture into the world market is destabilizing, as we can see from the experience of the '70s. Most other countries shield their farmers and consumers from excessive price variations by means of import controls and price supports. Our free-trade philosophy is splendid as long as we are not crushed by the burden of furnishing an ever-normal granary for erratic importers. So we may need to establish more regularity by agreements, forward contracts, and other means.

Finally, our interest in the developing countries, which are heavily dependent on U.S. grain, calls for a means of protecting their access to the U.S. market and not permitting the Russians and other large-scale buyers in the rich countries from crowding out the weak and needy. We need adequate reserves for stabilization purposes and for meeting emergency food needs in poor countries.

In recent years, the economics of grain farming--the world market, the relatively low cost of land-replacing chemicals, and a government policy which reduces the risk in grain farming as compared with livestock production--has driven farmers into exploitive practices.

In a large part of the Great Plains, these same forces have brought pressure on farmers to increase irrigation, dangerously depleting ground-water supplies. In the lower part of the Ogallala aquifer, the water level has dropped so low and the cost of pumping climbed so high that some farmers have returned to dry land farming. But the incentives for irrigation are still strong, in the Plains and elsewhere. The Ogallala aquifer contains fossil water which is not replaced by rainfall, so in this case we are mining an irreplaceable resource, just like petroleum. In other cases, erosion from heavy grain farming pollutes streams and other water supplies with agricultural chemicals and silt. Here soil and water conservation go together in obvious ways.

If the nation wants to conserve a food-producing capacity for the long run, strong arguments can be made for public action to offset the market forces which are causing depletion of topsoil and water. The direct way to do this is to pay farmers to retire from crops severely erosive land, adopt acreage set-aside programs to encourage rotations, and take other steps to encourage mixed livestock and grain farming rather than provide incentives for continuous corn and soybeans.

The question is whether we want to take action now or wait until the evidence becomes clear in the next century that food production capacity is being weakened. I vote for action on two fronts now--first, measures to conserve America's soil and water, and second, measures to make the poor countries less dependent on us for food.

Such action costs money, and anything that costs the government money now is "on the rejection front," as they say in the Arab world. But I think such steps at this time will save money in the long run and move us in the direction of the most important objective of all, a peaceful world.

The World Bank and Agricultural Development

Montague Yudelman

The World Bank is the largest provider of loans for agricultural development in the developing countries of the world. In the current fiscal year the Bank has committed US\$3.6 billion for 83 agricultural projects; these range from financing irrigation pumps in Bangladesh, building rural roads in northeast Brazil, helping establish fertilizer distribution programs in Zaire, and establishing large area-development programs in northern Nigeria, to assisting in the development of research facilities in Pakistan. Over the past five years, 1977-81, the Bank has committed more than \$17 billion for agricultural development; this investment has elicited \$2 billion in cofinancing and \$20 billion from local sources, or a total of \$39 billion. This is a very substantial sum, indeed, but most experts on the subject agree that total investment in agriculture falls considerably below the requirements for the sustained long-term increases in production that will be needed over the next twenty years or so.

Much of the need for additional investment is to make up for neglect of the rural sector in the years that have passed. In this connection the World Bank, in common with many governments and lending agencies, was not always a large investor in agricultural development. The change in emphasis given to agriculture by the Bank coincided with a change in perception about the role of agriculture in economic development and the needs and means for promoting agricultural development. I would like to begin by saying a few words about the Bank; thereafter, I propose to discuss the changes that have taken place in our perceptions of the problems of agricultural development and how we have responded to them; I would like to conclude with some reflections on the problems of the future.

THE WORLD BANK

The World Bank is an intergovernmental lending agency that is owned by its 139 member countries. The Bank is governed by its Executive Directors, whose votes are weighted by their contributions to the Bank's capital stock. The largest stockholder is the United States, followed by the United Kingdom, Germany, France, and Japan. Between them the Organization for Economic Cooperation and

This talk was given by Montague Yudelman at the Fourteenth Annual Quad-Cities World Affairs Conference, Moline, Illinois, on March 27, 1982. It is included in these proceedings because of its relevance to international agriculture and the important role being played by the World Bank.

Montague Yudelman: Director, Agriculture and Rural Development Department, the World Bank, Washington, D. C.

Development (OECD) countries own the majority of stock in the Bank, but the developing countries are also well represented on the Bank's Board of Directors. The Bank is thus a multinational institution with a multinational staff drawn from all its member countries.

It is important to know that the World Bank has two main components: the Bank proper, which borrows on world markets through its sales of bonds and then lends at near-international rates (currently 9.6% for 15 years, with a five-year grace period), and the International Development Association (IDA) which is made up of grants from rich countries, on-lent to the poorest countries of the world at highly concessional terms (1% a year for 50 years, with a ten-year grace period). The Bank is self-financing through bond sales in major money markets; its major borrowers are Brazil, Mexico, Malaysia, and Korea; IDA, on the other hand, consists of a fund that has to be replenished every three years. IDA's major clients are India, Bangladesh, and the poorer African countries. Currently there is some controversy over the sixth replenishment of IDA, which is intended to be \$12 billion for the years 1981-84. Without IDA the Bank group would have difficulties helping the poorest countries in the world--those countries that cannot afford to borrow at high cost.

I would like to emphasize several points about the World Bank:

The Bank is a profit-making institution, with a staff of more than 2,500 skilled professionals. There has never been a default on a Bank loan. Last year the Bank and IDA loaned \$12 billion (\$8.6 billion from the Bank, \$3.4 billion from IDA) and each loan was carefully scrutinized and appraised. The Bank's profits this year are expected to exceed \$500 million, most of which will go back into its reserves or be transferred to IDA for on-lending at concessional rates to low-income countries.

The Bank's Charter calls for loans to be made on the basis of economic criteria. The criteria are that loans should be for projects that are economically and financially viable and that the borrowing country should be credit-worthy and in a position to repay its loans. The emphasis on economics is essential because the Bank's members include countries with a wide range of political spectra: central-market economies as well as countries with free-market economies. Most of our poorer and more populous member countries, though, are in the tropics--a factor which has special significance in agricultural development.

THE CHANGING VIEW ABOUT AGRICULTURAL DEVELOPMENT

In the immediate postwar years there was very little concern about agricultural development, both within the newly established Bank and in the development community at large. The path for development was seen to be through industrial development with accompanying investment in urban-oriented infrastructure. An emphasis on heavy industry was encouraged by popularly held views, including Marxist ones, which tended to ignore agricultural development. The general assumption about the tropics was that there was plenty of land and idle labour; the limit on raising agricultural output was a low level of demand that would be raised by urbanization and industrialization. All that was needed to increase agricultural production was hard work and an appropriate incentive. Capital shortage was not a problem except, perhaps, in the export-oriented plantation

sectors such as rubber or tea plantations, and this capital could be provided by the foreign private sector.

With the passage of time it became apparent that there could be little overall economic development in most tropical countries, with their large agricultural sectors lacking agricultural development; linked to this problem was a growing awareness of the demographic explosion and the need to increase food production to keep pace with population growth, especially in Asia. These views coincided with important technological developments coming out of research stations in the tropics, notably, the evolution of high-yielding varieties of rice, wheat, and corn that could be grown in the tropics, giving much higher yields than traditional varieties when used with fertilizer and water. In addition, it became apparent that past neglect had led to tremendous underinvestment in the rural sector of the tropics.

The combination of a greater awareness of the socio-economic importance of agriculture and the availability of a technology that increased yields encouraged the Bank to expand its participation in agricultural development. Lending for agriculture rose from \$40 million a year to \$500 million a year in the decade of the 1960s. The major investments were for livestock in Latin America and for irrigation, especially in Asia; the larger part of the lending was still for export-oriented agriculture. There was very little lending for Africa.

Lending for agricultural development accelerated even further in the 1970s. There appear to be three principal reasons for this increase. First, as grandiose schemes for industrialization failed, it became more and more apparent that agricultural development was central to the economic development of many countries: a view reinforced by the food shortages of the early 1970s and by the World Food Conference. Second, there was a much better understanding of what was required to promote and encourage agricultural development, i.e., that agricultural development depended on a support system of many parts and that substantial investments were needed for many of the components in the system. Third, it became increasingly apparent that there was deep-seated poverty in the rural areas, so that efforts to alleviate poverty had to incorporate efforts to raise the output and incomes of the lowest-income groups in agriculture.

Lending for agriculture and rural development rose dramatically to more than \$3 billion a year in the late 1970s. The Bank's philosophy evolved into one based on the assumption that farmers were rational decision-makers who, if given adequate opportunity, would increase their returns. "Adequate opportunity" involved the existence or creation of conditions that would enable producers to increase production--these conditions included providing knowledge to farmers, as well as the means and incentives to use that knowledge. The implementation of such a philosophy calls for increasing investments in services. Such investments would include research (to provide knowledge and technology), extension (to diffuse knowledge), credit (to make available the means to use the knowledge), infrastructure (including roads and irrigation), storage, and markets to help move the farmers' products. Thus, the lending program for agriculture expanded on a broad front in an attempt to strengthen the whole agricultural system in many parts of the tropics. There have been notable successes in developing many of these services, especially extension services in parts of Asia. However, there have also been difficulties and failures, and these are especially costly where the expansion of such services places a heavy burden on government budgets without increasing revenues to offset the higher costs. The point to emphasize,

though, is that lending operations for agricultural development should be seen as parts of a whole, not just random efforts.

The need to come to grips with pervasive rural poverty has brought about a substantial change in focus and quality of much of our loan portfolio for agriculture. A substantial number of loans made by the Bank are designed to help low-income, low-productivity producers raise their output and incomes. In our view, this can best be done by ensuring that small farmers, tenants, and share croppers are given access to the same sort of services and means as are other producers--services and means that are traditionally reserved for larger producers. As a result, many of the projects financed by the Bank provide credit facilities for low-income producers to enable them to acquire seeds, fertilizers, pumps, and the like. In addition, projects are designed to ensure that small farmers have access to water, markets, and storage facilities. This shift in emphasis has required a great deal of effort in strengthening institutions that deal with small farmers; in addition, it has called for greater selectivity in helping to finance land settlement schemes and programs that involve the redistribution of land.

What have been the results of all these efforts? First, it is too soon to assess the impact of much of our program--many of our projects have yet to come to full fruition. However, we can point to some partial results. First, we estimate that over the past five years more than 25 million low-income farm families have been given an opportunity to increase their production and incomes to a greater extent than might have been the case. Thus, some 125 million rural poor could well be "better off" as a result of these investments. Second, we know that our efforts have helped governments increase food production in many parts of the world. We know, for instance, that we have helped irrigate one million hectares of land in Indonesia; a very modest estimate is that these investments have helped raise yields by one ton of paddy per hectare, or by one million tons. The same can be said of many other such efforts, with a very substantial cumulative impact.

Perhaps the most comprehensive analysis to the effects of Bank lending for agricultural projects can be discerned from independent evaluations of projects completed in recent years. These evaluations cover 160 projects with a total investment of close to \$7 billion. In appraising the impact of projects, it must be borne in mind that the effects of lending often extend beyond direct project impact; the Bank is a partner with governments not only in financing projects per se, but also in formulating decisions which influence the whole process of agricultural development. The objectives of development are wide-ranging, encompassing such elements as reducing rural-to-urban migration and improving urban food supplies. There is, however, one feasible common denominator for all projects that incorporate investments to increase production, and that is the economic rate of return. There are many pitfalls and problems in using this measure. Nonetheless, with the economic rate of return as the most important criterion of project performance, the evaluation of 160 projects, about five to ten years after initiation and after disbursement of Bank loans, presents a reasonably comforting picture. The analysis indicates that 40% of the investments have yielded at least a 20% return to the economy; a further 40% yielded between 10% and 20%, so that 80% of the investments yielded more than 10%; the remaining 20% yielded from zero to 10% but clustered around 8%. The overall weighted average was around 20%.

The most rewarding projects in this group were rural credit projects, especially in Asia, where the Bank made funds available to governments for on-lending to well-established rural institutions that in turn made loans to farmers to purchase inputs such as pumps and fertilizers. Other successful projects were irrigation projects, especially schemes that financed minor irrigation to enable farmers to grow two crops where one had grown before. There were high returns, too, for projects that helped finance tree crops--fruit, tea, coffee, cacao, rubber, and oil palm. The least successful projects involved attempts to increase livestock production, especially in Africa, and to expand production in semi-arid farming areas.

The Bank's largest borrowers are in Asia, and it is particularly gratifying that most projects in Asia have been successful. At the other end of the spectrum, the lowest returns have been in sub-Saharan Africa and in parts of the Caribbean. These differences reflect, in good measure, the difference in human infrastructure and natural resources in different parts of the world. I will touch on this in the discussion in the future.

Let me add that we are concerned about improving our performance--governments bear the costs of failures. We believe we have developed procedures for systematically learning from experience; these guidelines are helping governments with Bank support, to minimize the mistakes of the past. Our record, though, gives us confidence as we look to the problems of the future.

THE FUTURE

I would characterize the current situation as one wherein there is a food and agricultural problem but not a crisis. I say this because production throughout the world has exceeded population growth rates in all the regions of the world except in sub-Saharan Africa and parts of Indo-China. There are special problems in these areas, but these problems should not obscure the truly remarkable advances that have occurred in India, China, Brazil, Bangladesh, and Indonesia--countries that account for two-thirds of the population in developing countries, and countries where there have been remarkable increases in inputs, such as the five-fold increase in fertilizer consumption in Asia in the past decade.

There is, though, a deep-seated problem confronting the populous tropical economies that can be highlighted by the changes that have taken place in the structure of global trade in grains. Whereas 40 years ago there was a very limited trade in grains--less than 20 million tons a year--it has now grown close to 200 million tons a year. This phenomenal increase has been accompanied by a significant change in partners in trade. Formerly there were many grain exporters, including tropical economies, and a few importers; now there are a few exporters and many importers, including tropical economies. The major exporters are North America and, to a much lesser extent, Argentina, Australia, and South Africa. The importers include both developed and developing countries, with the most rapid increases in imports being in the middle-income developing countries. The overall growth in increased imports reflects changing patterns of consumption as urbanization proceeds and incomes rise; as people have larger incomes, they desire more wheaten bread, meat, milk, eggs, fruit, and vegetables. At the same time many countries, while increasing production, have not been able to increase supply rapidly enough to satisfy the increasing demands of their more affluent population. The result has been that countries have drawn down their own

reserves--especially of grain--and have had to import their additional requirements. The consequences are that, to all intents and purposes, North America has become the breadbasket of the world and the main hedge against food shortages. However, the capacity of North America is not limitless, and there are signs that the costs of sustained expansion in North America to meet growing exports may be high in terms of the over-exploitation of physical resources. This factor serves to reinforce the view, widely expressed at the World Food Conference of 1973, that there has to be a much greater effort to increase food production outside of North America and in the tropics.

What then is needed to increase production? Let me start by saying that there are no shortcuts to agricultural growth. Millions of producers have to be convinced that they should increase production and try ways different from the past--not an easy task in most societies. Also, we must recognize that there are substantial differences among countries and regions. Bank experience confirms that preconditions for development differ substantially among regions. For example, a strategy for agricultural development of Africa must place much greater emphasis on developing "human infrastructure" than, say, a strategy for India, with its large number of trained persons and its well-organized civil service. In the future a much greater effort will have to go into training and technical assistance in Africa than elsewhere for developing such areas as well-managed credit agencies and irrigation authorities. I believe that there will be major efforts in this direction, in the form of investment in human capital formation in Africa in the 1980s and 1990s.

As we look ahead, it may be useful to distinguish between two broad sets of technical problems that face the developing world. The first deals with the spread of available technologies and the second with unsolved technical problems. With regard to the tested technologies, I refer to the use of improved seed, sufficient water, and plant nutrients to increase yields, an essential requirement for growth. As far as I can see, the use of high-yielding varieties will continue to be the major technology to be used to increase production throughout the irrigated areas of much of the world, especially the populous rice-producing areas of Asia. These are the areas where there are few opportunities to expand acreage so that increases will necessarily have to come from higher yields. Fortunately, there are still ample opportunities to raise yields, as current levels of production are well below levels obtained at research stations in Asia as well as the levels attained in the field in areas such as the Po Valley in Italy or Louisiana in the U.S.A.

I believe that, with the existing technology, it is possible to double the production of staple foods such as rice, the basic food of two billion people. To do so calls for increasing investment in making the necessary inputs available to farmers, especially those that are part of the hitherto successful technology: improved seeds, fertilizer, and regular water supplies. In addition, there has to be continuous research to improve the varieties of seed available, as well as to protect the gains from new pests and diseases. In recent years the Bank has invested increasingly in promoting research, seed production, and extension, and it is expected that the Bank will continue to invest an increasing proportion of its resources in financing research and extension services as elements in the system needed for sustained increases in production.

There appears to be no large-scale viable alternative to the use of chemical fertilizer as a source of plant nutrient. There has been a steady growth in the

manufacture and use of fertilizer in developing countries. Indeed, the recent outstanding successes in Asia are closely linked to increases in fertilizer use. The World Bank has financed about one-third of the increase in fertilizer-manufacturing capacity in the developing countries in the past decade. The Bank has also helped finance the vast expansion of fertilizer use by farmers in many parts of the developing world. Energy-related problems have pushed up the costs of chemical fertilizer but despite this, I repeat that I see no viable option to increasing yields substantially without the increased use of chemical fertilizer. The higher cost simply means that there will have to be greater efficiency in the use of fertilizer. The Bank, as a lending institution dedicated to increasing production, will most certainly continue to give high priority to projects that increase the production and availability of fertilizer.

The next twenty years will see a substantial increase in irrigation, above and beyond the areas already irrigated in the tropics. Our experience, though, is that real costs are rising and that while there are opportunities for the substantial expansion of irrigation, much more attention will have to be paid to the improved management and use of water. In many parts of the world water is treated as a free good and a renewable resource. In our view, it will become increasingly scarce, relative to the need, and will have to be used more and more efficiently. We in the Bank are continuing to devote considerable funds to irrigation, but at the same time we have begun work with governments to develop ways and means of promoting more efficient use of water. I expect that irrigation will continue to be the largest component of our lending program for agriculture, but there will be greater emphasis on raising the return on investments by improving maintenance, reducing waste, and improving water use at the farm level.

The second major technical issue in the coming decade involves the exploitation of large parts of the tropics that are potentially productive, given the right kind of technology. There are more than two billion hectares of such land in South America and Africa, and many millions in regions such as the outer islands of Indonesia. These areas can support tree crops like rubber and oil palm, but there are no proven technologies for sustained food crop production there. Such areas are used for low-yielding shifting cultivation. At present, the application of temperate-climate agricultural technology simply doesn't work very well in these tropical regions. We don't know yet how to make them bloom but, I submit, we do know how to find out; we must proceed to unlock this potential soon, so as to contribute toward increasing food supplies. Unlocking this potential will require a substantially larger effort than at present. Much of this effort will have to be in developing the means of sustaining food production. To do so means more research--but research with a difference; it would be research on developing farming systems that could thrive in the tropics.

Several research institutions are involved in finding out how the poor soils of north Brazil, the Llanos of Colombia, the shifting cultivation areas in Africa, and the outer islands of Indonesia can be made more productive. These centers, including the international centers of the Consultative Group for International Agricultural Research (CGIAR), certainly deserve very strong support from the agricultural community. There are some indications that the use of certain chemical additives can make a major contribution toward rendering vast areas of land in the tropics more productive; however, much of the research is still on the threshold of discovery. The promise is there and results will come from perseverance. The same resolve applies to freeing large areas of Africa from the tsetse fly; continued efforts by the work of animal scientists may soon bring us to a point where we can free hundreds of millions of acres from this scourge.

CONCLUSION

Looking ahead, I would expect the World Bank to continue to play a leading role in increasing food and agricultural production in the developing countries. I have mentioned three known ingredients for increasing production--improved seeds, sufficient water, and plant nutrients--and the increases in investment in research, irrigation, manufacture, distribution, and application of fertilizer. As a means of facilitating their use, the Bank has supported these activities and will continue to do so. I have also mentioned the need for much more work on the development of techniques for use in large areas of the tropics which are currently underutilized. The Bank will continue to assist in the solution of these problems.

Many other conditions have to be fulfilled in the coming years if there are to be the desired increases in production. Our own experience indicates that perhaps the most important of these needs is for appropriate economic policies--policies that do not discriminate against farmers but provide adequate incentives to farmers to increase production. Without these incentives, then, all the investment in the world will only give very limited results--a lesson which has been learned by some countries but by no means by all.

I think the Bank will continue to attempt to raise the productivity of the rural poor and thus the prospects for rural people living in poor countries. The Bank, however, will only be able to help the poorest countries if it has the resources to do so. I refer particularly to the funds for IDA. At present many of the rich countries of the world are looking inward and are preoccupied with their own problems; they are inclined to reduce their support for agencies such as IDA. In my view a lessening of support would be a mistake and might well help convert what I have called a food problem into a food crisis since, without capital, the poorest countries would have great difficulty in increasing production. Such a policy could well result in the sowing of seeds of despair rather than of hope.



tion and Food Policy atin America

L. Paul Oechsli

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This problem will be further aggravated due to both the alarmingly rapid
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CONCLUSION

Looking ahead, I would expect the World Bank to continue in increasing food and agricultural production in the areas I have mentioned three known ingredients for increasing production: sufficient water, and plant nutrients--and the investment in research, irrigation, manufacture, distribution, and as a means of facilitating their use, the Bank has said it will continue to do so. I have also mentioned the development of techniques for use in large areas of land currently underutilized. The Bank will continue to work on these problems.

Many other conditions have to be fulfilled in the order to achieve the desired increases in production. Our own experience shows that the most important of these needs is for appropriate policies that do not discriminate against farmers but provide incentives for them to increase production. Without these incentives, the world will only give very limited results--by some countries but by no means by all.

I think the Bank will continue to attempt to raise the living standards of the poor and thus the prospects for rural people living in the poorest countries, however, will only be able to help the poorest countries to do so. I refer particularly to the funds for the poorest countries; they are inclined to reduce their support for the poorest countries of the world are looking inward and are not looking outward. In my view a lessening of support would be a mistake. What I have called a food problem into a food crisis. The poorest countries would have great difficulty in solving the problem. Policy could well result in the sowing of seeds of

Food Production and Food Policy in Latin America

L. Paul Oechsli

I am particularly pleased to be at this Conference for somewhat selfish reasons. We at the Inter-American Development Bank (IDB) are currently putting the final touches on a new agriculture sector policy paper for presentation to our Board of Directors and at the same time preparing material on the importance of food and agriculture development as part of our justification for a Sixth Replenishment of the resources of the IDB. Participating in this conference, therefore, has been very beneficial for me.

With respect to the topic assigned, "Prospects for Agricultural Development in Middle-Income Countries," I will be speaking of the situation in Latin America, which is generally considered to be within the middle-income category.

However, because of the widespread perception that much of Latin America has attained middle-income status in the development process, there is a tendency to be overly optimistic about the development of agriculture in the region.

Thus food production and rural development problems are considered less pressing in Latin America than elsewhere. It is true that Latin America is a net exporter of agricultural commodities. Studies have shown that Latin America, relative to other regions, has had a good performance in food and agricultural production during the last two decades. The output of the agriculture sector has exceeded the growth in population, with per capita food output doing better than per capita agricultural output. Agricultural exports increased 28% from the base period 1969-71 to 1978. For the same period food exports increased 38%.

However, such data on expansion tends to conceal pressing problems and other less optimistic trends, which are related to the development of the food system. Thirty-five percent of the region's population are affected by chronic undernourishment, with 20% suffering from severe malnutrition. In the last decade Latin America has increased its food imports nearly 100%, a rate three times greater than its growth of food exports. The contribution of the agriculture sector to the gross domestic product (GDP) has decreased steadily in the 1970s from about 15% to 10%. The low level of productivity is reflected by the fact that nearly 40% of the work force continues to be employed in the agriculture sector.

This problem will be further aggravated due to both the alarmingly rapid population growth, which is estimated to result in a population level of

L. Paul Oechsli: Chief, Policy Division, Plans and Programs Department,
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550 million by the end of the 80s, and the exceedingly rapid rate of migration to the urban areas.

Food and Agriculture Organization (FAO) studies indicate that if recent trends continue through the years 1990 and 2000, many Latin American countries will become substantial importers of agricultural and food products such as cereals, vegetables, vegetable oils, and animal products. Currently, all the Latin American countries together import food products at a combined total cost of approximately five billion dollars per year.

In the past, fiscal and monetary policies have generally benefited the growing urban population, to the disadvantage of the rural sector. Within the agricultural sector the narrowly based export and commercial sector has been favored as compared to the small and medium farmers who are major producers of food. At a macroeconomic policy level, the heavy emphasis on import substitution industrialization has increased input costs to agriculture and kept agricultural prices low relative to the industrial sector. Also, food imports were encouraged by the public sector to cover the rising demands in urban centers which could not be met by local producers. Recent marketing investments to replace old marketing systems have been import oriented rather than domestic market based. Food policies have contributed to two undesirable trends: the persistence of rural poverty and the uncontrolled growth of urban centers.

FAO studies have projected that during the present decade, food self-sufficiency is an unattainable and unrealistic goal for most Latin American countries. Therefore, at the moment, the priority for agriculture and food planning is the attainment of an increased degree of food security, which will have to be determined by each country in relation to its own circumstances.

The considerable agricultural potential of Latin America as a region is well known and undisputed. This potential arises from a substantial natural and human resource base, relatively substantial infrastructure arrangements, an expanding technological research and development system, and a reasonably effective input service sector.

The potential is such that Latin America could become an increasing exporter of certain export crops, including some food crops. However, at the same time it will become an increasing importer of important food items.

In the past 15 years, two-thirds of the growth in food and agricultural production has come from putting increased acreage under cultivation. Despite the fact that the potential for area expansion is still significant, many of the relatively easy production gains from expansion have been obtained and the agricultural frontier has become more restricted and costly to exploit. Current calculations are that about half of expected increases in agricultural production will have to come from increased yields. Given the low level of agricultural productivity, this figure represents a relatively large potential for food and agriculture expansion. An increase in agricultural productivity is a basic condition to the overall development process.

It has been shown that throughout the developing world, including

Latin America, the countries that achieve the highest sectoral growth rates are those in which yield increases play a dominant role. Although technological progress in agriculture is not as novel to Latin America as is often assumed, a sustained and systematic approach to improving technology is a fairly recent phenomenon.

Fertilizer use, a good indicator of technological change in farming, increased at a yearly rate of 12 percent from the 1961-65 base period to 1976. If this rate can be sustained throughout the eighties, it should have a substantial impact on output. The use of improved seed has also spread, especially in the case of rice and wheat, but also in other crops such as corn and cassava. Since traditional crop varieties do not always respond well to fertilizer, the development of improved varieties is often a precursor to efficient fertilizer use.

In contrast to the rapid expansion in fertilizer use, tractor numbers increased by only five percent annually, and growth in the areas of farmland under irrigation was only two percent per year.

Given the clear indication that increased agriculture production in Latin America will have to come increasingly from higher yields and productivity, the effort to create and diffuse yield-increasing technologies must be continued and strengthened.

In this regard, the Inter-American Development Bank has continuously supported the efforts of the national governments, and of the international agricultural research centers located in Latin America: the International Maize and Wheat Improvement Center (CIMMYT), in Mexico; the International Center of Tropical Agriculture (CIAT), in Colombia; and the International Potato Center (CIP), in Peru. Also, it has maintained an active collaboration with the Inter-American Institute of Agricultural Sciences (IICA), which provides regional services. The international agricultural research system is already speeding the generation of needed technology, and efforts to date have been good. Forthcoming "breakthroughs" can be expected to involve durum wheats, tropical maize, barley as a food consumption item, beans (which are so important in the Latin American diet) and remarkably improved forage crops. Improvements in the major food crops are on the way, but years of work are still required to achieve significant contributions to yield increases. If these efforts are adequately supported in the future, they should provide payoffs of considerable magnitude.

But along with improved technology and the extension of that technology to the farmer, there must also be policy changes that permit appropriate prices to provide incentives for the domestic producer and domestic marketing mechanisms that upgrade or replace the outmoded and high-cost existing systems.

The process of redefining food policies and transforming an import-based marketing system into a domestic production-based system will be difficult, but should produce multiple benefits in the long run. Such benefits include rising domestic food security, increased local rural income and employment, stronger linkages between agriculture and industry, and regional development, particularly if small holders participate to a greater extent in the food marketing system.

There appear to be some internal conflicts in formulating agriculture policy which apply especially to the middle-income developing countries. With the rapid growth in demand for food and other agricultural products that derives from the exceptionally rapid expansion of urban population centers, where should the emphasis lie in meeting this demand? Helping the bigger producers produce more food faster? Concentrating on exports of agricultural commodities in order to have foreign exchange to import food from efficient food-producing regions, such as Illinois? Or putting all the emphasis on the small and medium farmers who are the traditional food producers?

The answer, undoubtedly, is in developing a balanced approach which will eventually provide a sound strategy for the food security of each country or subregion. But the area that may be the most difficult and perhaps the most important is in assisting the small and medium farmer.

There is, I believe, an outstanding opportunity to combine programs and activities both to assist low-income beneficiaries and to support agriculture and food development programs. The Bank is particularly interested in identifying investment projects that assist low-income groups. Such programs can serve a dual purpose of increasing incomes, and hence the food security of rural low-income families, and increasing food production which will, in the near term, increase the food security of urban low-income groups. Rural and regional development programs are appropriate vehicles to expand food production and improve the level of living of rural inhabitants, and the Bank continues to be interested in financing such programs.

Another policy conflict is rapidly arising which is also of particular importance to the middle-income countries. With development comes a growing demand for energy. And we all know the foreign-exchange implications of high-cost imported fuels. Since public policies have fostered domestic energy prices that are in accord with world market prices, energy production from agricultural biomass has become a viable economic alternative. Similarly, technological developments have made local energy production potentially feasible from biomass sources. This new policy presents both an opportunity and a problem for the agriculture policy makers. Brazil is known to have begun an ambitious national energy program based upon wood, wood residues, and crop production, and other countries are beginning to consider similar programs as a real option. Large-scale production of crop-based alcohol is a reality in a number of countries already.

Concern has arisen over the competing uses of foodcrops--sugar, cassava, maize--and the change in land use patterns. Particularly, there is a concern that the supply of staple foodstuffs might be reduced, and this decrease would affect the nutritional intake of low-income groups. The eventual consequence of increased consumption of food crops as energy sources will depend upon several factors, including the technological advances in crop yields, their relative domestic prices, world market prices, and the potential for expanding the land base. It would appear desirable to invest in the improvement of crop varieties, cultural practices, and other elements of a technological package for key energy crops in anticipation of improved market prospects.

To improve the agricultural sector and the food system planning, and in order to obtain the goal of increased food security over the next decade, it can be anticipated that large investments will be required. Countries at the stage of "middle-income" in the development process may need larger amounts of external resources. Because of the increasingly capital-intensive nature of Latin America's agricultural and food system development, it will have to obtain constantly larger financing for priority sub-sectors from capital-exporting countries and multilateral agencies. In this regard, we hope that the Sixth Replenishment of IDB resources will enable us to play a major role in this vital aspect of the development process.

In closing, let me note that in addition to the apparently improving weather, I have irrefutable evidence that spring is on the way. The mailman has already brought me at least 12 seed catalogues--the robins can't be far behind.

But to return to that part of the theme of this conference that refers to "Its Importance to Illinois and the Nation." Each one of those seed catalogues contained glowing reports of a significant breakthrough--the development of true seeds for the growing of potatoes. Of course we all know that potatoes originally came from the Andes of Peru, for which we owe a great debt of gratitude. But now the development process in Latin America is bringing us a new technology; for a major share of the work in producing true potato seed was done in Peru at the International Potato Center. Now I recognize that out of 38 potato-producing states, Illinois ranks 32nd--but surely there are some backyard gardeners out there who are going to enjoy this technological breakthrough.

The Outlook for Food Exports to Industrialized Countries

Jimmye S. Hillman

In an historical context, food exports have, for a century or more, linked the United States with industrial countries; first to Europe as a human energy basis for the Industrial Revolution, and more recently to Europe, Japan, and others as a stabilizer on which the surge of economic growth took place. In the latter part of the 19th century and until World War I cotton and tobacco overshadowed wheat, but in recent decades, wheat, feed grains, and soybeans have been predominant.

As recently as the mid-1960s, the President's National Advisory Commission on Food and Fiber (1967), observing that U.S. farm exports had been about \$6 to \$7 billion for several years, estimated that ". . . exports of \$8 billion are projected for 1970 and \$10 billion for 1980" In retrospect, this estimate might be called the underprojection of the century: in fact, in 1980 (fiscal) U.S. farm exports were \$40.5 billion. To be sure, inflated prices accounted for some of this increase, but record exports which began in the early 1970s continued apace and only recently have begun to abate.

The growth spurt in U.S. agricultural exports which began in the late sixties and accelerated with the anomalous world circumstances of 1972-74 has set records for 13 consecutive years (assuming the forecast for the current fiscal year to be accurate). How long can new record exports be expected each year, assuming relatively modest inflation in product prices? Those who caution that the boom in farm exports might have leveled off have some valid arguments to present.

I will now speak ex tempore on the subjects in the following outline:

I. World Economic Conditions: Impact on U.S. Exports.

A. Growth very slow in 1980, continued in 1981. Will remain sluggish--secular decline?

1. Growth below 1.5% in Organization for Economic Cooperation and Development (OECD) continues in 1981; 1982 continues slow.
2. Energy prices will remain a problem for growth.
3. Faltering productivity--slowing of innovations.
4. Population--its stability and mix in developed countries.

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- B. Government policies: Restraining fiscal and monetary growth in OECD countries.
 - 1. Unemployment likely to remain high.
 - 2. Policies for subinterest rates, therefore, lower inventories; low prices even with less stability mean lower margins for traders.
 - 3. Demand for credit high.
 - 4. Increased transfer payments and lower tax revenues.
- C. Personal consumption down due to many factors, including high money cost, hence cut in exports. Also, changing eating habits--less meat? fewer grain exports for feed.
- D. Projected lower investment, except in Japan.
- E. Projected tight policies in general, except France.
- F. Policies help slow inflation, but also slow exports.
- G. U.S. position cloudy: dollar strength: fewer exports.

II. Competition from Western European and temperate-zone agricultural exporters.

- A. World agricultural production will continue to grow.
 - 1. Australia, New Zealand, Argentina, Canada.
 - 2. Europe now exporting wheat and subsidizing it.
- B. Protectionism on the rise again. Mutual subsidization generates protection.
- C. The agricultural policies of the U.S. and the countries in the European Community (EC) are inspired by different economic philosophies. The U.S. farm program is designed to interfere as little as possible in international agricultural markets. When prices are low, the Commodity Credit Corporation (CCC) takes over, and along with farmers, holds surplus U.S. production; it does not dampen world prices by subsidizing exports. Our farmers hold the world's largest grain reserves, thus contributing to world food security and international price stability.
- D. The EC's Common Agricultural Policy (CAP) is based on high price supports. It has no production controls and protects prices by variable levies at the border. It has created burdensome surpluses and serious budget problems for the Community. By subsidizing exports, it has artificially stimulated large-scale European exports in such products as wheat, sugar, and meat. This policy limits market opportunities for products of countries like the United States, which compete without subsidies.

III. Less money for food aid--except surplus disposal of agricultural products--means fewer exports for dollars.

IV. Foreign Agricultural Exports of U.S.

- A. The industrialized world in 1970 is different from the industrialized world of 1980.
- B. U.S. Agricultural Exports.
 - 1. Share of U.S. production
 - 2. Share of world trade.
 - 3. Exports for fiscal year.
 - 4. Tonnage exports for fiscal year.

V. End of an era for exponential growth of U.S. exports, the era which began in 1972.

- A. Rising interest rates around the world discourage grain dealers from building inventories.
- B. Food demand slowing in industrialized countries due to recession.
 - 1. Rising protectionism.
 - 2. Export subsidization--e.g., on European Economic Community (EEC) pear subsidies.
- C. Rising debt forcing many countries--already burdened by oil costs--to devote dollars to service cost of energy debt, which means less for food imports.

VI. World food outlook in general.

- A. Much brighter in '82. See Food and Agriculture Organization (FAO), January 1982 Newsletter. World cereal production 1,517 million tons, up 6% from 1980, a record. World food stocks up 11%; stocks of coarse grains up 25%.
- B. To the extent Eastern Bloc and Third World solve their food problems, there will be fewer U.S. exports, due to indirect "backing up" of temperate-zone exports to them, and world competitive market.
- C. Self-sufficiency being promoted everywhere.

VII. Impact of exports on environment.

- A. Environmental Protection Agency (EPA).
- B. Soil Conservation Service (SCS) and erosion.
- C. Metropolitan spread and land use.

VIII. Farmers again looking to Washington rather than the export market?

The World Food Situation

Implications for Illinois

Earl D. Kellogg

Few topics have received more international attention in the past ten years than the world food situation. Yet, a common understanding of the dimensions of the associated problems still seems to be lacking among the public, our political leaders, and even professional agriculturalists. This lack is due to the size and scope of the problems, the differences among and within geographic regions, and differing perceptions of which actions would be effective in reaching short-, medium-, and long-term objectives in alleviating world food problems.

THE WORLD FOOD SITUATION

To make sense out of the almost bewildering sets of information on the current state of the world food situation and what ought to be done about it is a far greater task than can be accomplished in a 20-minute talk. Therefore, I plan to limit my presentation to a broad look at world food production, population trends and projections among geographic regions, and the general implications of the world food situation for Illinois.

Much of the current popular writing on the world food situation focuses on the short run (how much food was produced last year or will be produced next year) and either broad world totals or single-country problems. To better understand the current situation and the likely future requires some historical perspective and world regional comparisons. Most of the data used in this section is taken from various world agricultural situation reports from the U.S. Department of Agriculture. Much of this information has recently been issued in Statistical Bulletin No. 669: World Indices of Agricultural and Food Production, ERS, USDA, July 1981.

Figure 1. Total World Food Production

Since I am most interested in showing trends and comparing rates of change, much of the data is presented in graph form, where the absolute values of the variables are converted to percents of the average for 1961-65. For example, if the world food production in 1972 was 124, this means that, in 1972, food production was 24 percent greater than the average food production for 1961-65. Food production is not to be confused with agricultural production, which includes food plus inedible fiber products (e.g., cotton, hemp, kenaf, wool) and non-caloric products, such as tobacco, coffee, tea, and spices.

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World food production has been increasing relatively steadily in the past 25 years at about 2.5 percent annually. However, for the past decade, the total world food supply has been increasing at a slower pace--about 1.7 percent annually.

Even with this reduced growth rate, there is about twice as much food being produced in 1981 as there was in 1954. However, as will be seen later, this fact does not imply that we have made much progress in alleviating world food problems.

Figure 2. Food Production in Developed and Developing Countries

More developed countries include the U.S., Europe, USSR, Australia, New Zealand, Japan, Canada, South Africa, and Israel. The less developed countries are Latin America, Asia except for Japan and Israel, and Africa except for South Africa.

When one divides the world into the more developed nations (MDC) as contrasted to the less developed nations (LDC), their comparative food production records are not all that different, especially up to the early- to mid-1970s. Since then, food production has increased more rapidly in LDCs (3 percent per year) as compared to MDCs (1.7 percent per year). But total food production measures do not mean much without looking at population growth in investigating food availability per person.

Figure 3. Population Growth in Developed and Developing Countries

Population growth in LDCs has been and still is considerably higher than in MDCs. From the mid-1950s to the mid-1970s, population growth in LDCs was about 2.5 percent per year, while the comparable growth rate in MDCs was falling from 1.1 percent per year to 0.9 percent annually. Since the mid-1970s, however, the annual population growth rates for both sets of countries have declined to 2.0 percent annually for LDCs in 1980 to 0.7 percent per year for MDCs.

Figure 4. World Population Projections

Since birth rates seem to be declining in many countries, we now have somewhat lower estimates for the world population in 2000. In the mid-1970s, world population was projected to be 6.5-7.0 billion persons in 2000. Now, the total world population estimates range from 5.8 billion to 6.2 billion for the year 2000.

Table 1. Population Growth Rates of World Regions in 1981 and Projected for 2000

The present population growth rates are highest in Africa and Latin America; Asia is significantly lower in the LDC category. As indicated previously, the growth rate for MDCs is substantially lower. However, population growth rates are projected to continue to decline to the year 2000, with Africa continuing to be by far the fastest growing region in the world.

Figure 5. Proportion of World Population

Given these trends, we expect a continuing increase in the percentage of the world's population which will be residing in LDCs, from 73 percent in 1978 to 78 percent in 2000. This increase has important implications for world politics and economic relations.

Figure 6. Per Capita World Food Production

Given these food production and population trends, what has been the per capita world food production record? It has been increasing at a slow but steady rate since 1954, with slower growth in the early 1960s (almost no growth) than from 1966 through 1980 (0.4 percent per year). Unlike total food production, per capita food production has shown a number of declines from one year to the next, most notably in 1971-1972 and 1978-79-80. It appears that in 1981, the world food production per capita will once again increase after two straight years of decline. However, to have improved only slightly from an undesirable situation in the 1950s and 1960s does not constitute major progress in alleviating world food problems.

Figure 7. Food Production and Population Change in Developed Countries

The per capita food production picture is quite different in MDCs as contrasted to LDCs. Total food production in MDCs has increased at over two percent per year, while population has grown at a one-percent rate for the 25-year period from 1955 to 1980.

Figure 8. Food Production and Population Change in Developing Countries

In LDCs, population and food production have grown at similarly high rates, particularly up to the late 60s. Only since then have the LDCs begun to increase food production faster than population growth rates.

Figure 9. Per Capita Food Production in Developed and Developing Countries

These different historical trends between the MDCs and LDCs have, in the past 25 years, worked to produce quite different per capita food production records. In general, because of lower population growth rates, per capita food production in MDCs has been increasing much more rapidly in the past 25 years than per capita food production in LDCs (1 percent per year vs. 0.4 percent per year). However, except for 1970-72, per capita food production in LDCs has been increasing since 1966. I hope this trend will continue.

Figure 10. Food Production Per Capita--Developed Regions

Oceania, U.S., USSR. The per capita food production record, however, varies among countries and regions within the MDC and LDC categories. The U.S., USSR, and Oceania (Australia and New Zealand) all have records of increasing per capita food production; the increase in the USSR has been particularly rapid

(but from a much lower base than the U.S.). However, the noticeable characteristic about the USSR's record is its variability. With difficult, uncertain weather and agricultural organization problems, food production can change substantially in the Soviet Union from one year to the next (8-10 percent annual changes are not uncommon). Food production in Oceania is also quite variable.

Eastern and Western Europe. Both Eastern and Western Europe have increased food production per person steadily in the past 25 years, partly because both regions have had very slow population growth rates.

Figure 11. Food Production Per Capita--Developing Regions

Latin America, West Asia, East Asia, South Asia. Latin America includes Mexico, Caribbean countries, Central American countries, and South American countries. West Asian countries, for these purposes, are defined as Cyprus, Iran, Iraq, Jordan, Lebanon, Saudi Arabia, Syria, and Turkey. East Asia includes Burma, Indonesia, Republic of Korea, Malaysia, Philippines, Taiwan, and Thailand. Countries in South Asia include Afghanistan, Bangladesh, Sri Lanka, India, and Pakistan.

All of these LDC regions have similar records--slow growth in food production per capita, especially up to the early 1970s, then moderate growth in the mid- to late 70s.

Africa. Africa's record is substantially different from that of any other major region in the world. Food production per capita has been steadily declining since the mid-1960s. Remember that Africa also exhibited substantially higher population growth and is projected to continue to have the highest population growth rates in the world. Major food production problems exist in Africa, such as low levels of knowledge regarding African food crops, lack of research and extension systems geared to food production, new nation states still maturing politically, lack of basic transport or communication infrastructure in many rural areas, and problematic agricultural policies.

Table 2. Average Per Capita Daily Food Supply by Region

Given these geographic differences, where are the hunger problems most prevalent? In terms of protein and calories, Africa and the Far East (South and East Asia) have the lowest per capita food supplies. In general, almost all of the progress made in increasing per capita protein supplies in the 1960s and early 70s occurred in the developed countries. The data on calories supplied per capita imply that broad progress was made but that several regions still have substantial calorie gaps to close before reaching per capita food supply requirements. Since these data are averages, it is generally accepted that a value of 110 must be obtained to provide reasonable assurance that most lower income persons have access to calorie requirements. In terms of calories, Africa and the Far East are substantially below other region averages.

Table 3. Estimated Number of Persons with Food Intake Below the Critical Minimum Limit

Such estimates are extremely difficult to develop accurately. The results of serious attempts to estimate the number of persons affected by hunger range from 100 million to 1,000 million.

The dismal pattern is repeated when looking at the hunger problem in terms of percentage of people hungry and total number that are thought to be hungry. While these absolute numbers are not very reliable, they do provide an indication that solid progress is not being made in reducing the proportion or absolute numbers of persons who are hungry. The problem again seems to be most serious in Africa and both South and Southeast Asia.

Summary and Other Dimensions

To summarize and briefly extend the analysis of world food problems, the following statements are given:

Only modest progress is being achieved in increasing per capita food supplies. The proportion of the world's population who suffer calorie malnutrition is probably holding steady if not increasing, while the absolute number of people who are affected by malnutrition is probably increasing.

Weanling children from ages one to four and pregnant and lactating women are the special population groups which have the most serious incidence of malnutrition.

While famines induced by war and bad weather are often well-publicized and horrible, the biggest hunger problem is chronic calorie malnutrition among millions of persons in several countries.

The largest number of persons affected by hunger live in South and Southeast Asia. The highest incidence of hunger occurs in Africa.

The major reason people are hungry is not that there is not enough food in the world; it is because people are poor. Chronic hunger results from a lack of purchasing power by poor countries and poor families when they compete for the aggregate world or country food supply.

The global environment for solving hunger problems changed substantially in the 1970s and is, in some important aspects, becoming more difficult.

The simplistic categorization of the world into rich/poor countries or East/West countries is not very helpful in understanding world food problems or deciding on feasible actions for their alleviation.

Only a modest amount of progress is being made on increasing the production of food to keep up with population growth. Major problems remain in even keeping the proportion and number of persons who are malnourished from increasing. There were large numbers of malnourished people in the world in 1954; to have increased the per capita food supply by only 0.7 percent annually during the past 25 years cannot be considered a major improvement. Given wide distribution within

countries, this slow growth has probably resulted in increasing proportions and numbers of malnourished people in the world. The effects of this malnourishment are debilitating in the form of poor health, low labor productivity, low educational achievement, and political unrest. Improvements in food distribution and production, continued progress at reducing child mortality and rapid population growth, investments in infrastructure, and improved agricultural policies of both MDCs and LDCs will aid in making progress toward insuring food security for the millions of poor persons in the world. For humanitarian, agricultural market development, and political stability reasons, it is important to the U.S. and Illinois that such steps be implemented.

IMPLICATIONS FOR ILLINOIS

The changes in the world food situation and the impacts on Illinois vary among groups of countries facing quite different futures. Changes in the developed countries, the less developed countries where effective demand for food is growing rapidly, and the slowly growing poor countries will have different implications for Illinois.

The global environment for accomplishing this food security goal is quite different now from that of the 1950s, 1960s, and early 1970s. In those times, world stocks of grain were about 20 percent of utilization, moderate amounts of idle land in North America were available for being brought into production relatively quickly and at low cost, and a population of about 450 million persons in Western Europe and Japan were major markets of North American and Australian grain. So, when Asian countries in the 1950s and 60s experienced lagging agricultural sectors in their early stages of development, they were able, in periods of food scarcity, to draw upon low priced "surpluses" generated by the high income food and feed grain exporters.

LCDs With Rapid Food Demand Growth

Now, the picture is substantially different. World stocks of grain are only 12 percent of utilization, little idle land in North America can be brought into production without substantial costs, and populations of 1.7 billion persons are becoming active in commercial markets for food products. In the next few decades, a surge in demand for food will come from several countries where rapid per capita income growth and political pressures for increased per capita food consumption are developing. China, with about a billion people, will probably continue to be an important trade demand source for food commodities, although it might be easy to overestimate China's actual food imports over the next few decades. The oil countries (Indonesia, Iran, Iraq, Mexico, Nigeria, Saudi Arabia, and Venezuela) have an aggregate 1981 population of 379 million people and high per capita income growth rates. Food imports rose an average of 19 percent a year in these countries in the 1970s; with oil revenues, these countries will continue to grow rapidly. Another 380 million persons live in Brazil, Hong Kong, North Korea, South Korea, Malaysia, the Philippines, Singapore, Syria, Taiwan, Thailand, Tunisia, and Turkey. Population and per capita income growth combined will probably cause food demand to increase at 5.0 percent a year--a sustained rate rarely matched in the past by growth in food production. The resultant pressure to import is clearly indicated by the doubling of food imports by the developing countries from 1970 to 1977. Most of these rapidly growing,

less developed countries in these two categories are former or current recipients of U.S. foreign aid. Foreign aid criticism has been so severe that we have often failed to notice the substantial development success that many recipient countries are having and the growing markets they represent for our food exports.

Because of Illinois' particular mix of farm outputs, agricultural input businesses, and favorable location for movement of commodities into world markets, the State of Illinois will certainly be affected by the changes that are occurring and will continue to occur in the world food system.

As for the output sector, agricultural commodity exports in Illinois are about 42 percent of total cash receipts from farm marketings in the state. Illinois ranks first among all the states in the U.S. in agricultural commodity exports, exports of feed grains and products, and exports of soybeans and products. The export of meat and meat products from Illinois is the fifth highest in the U.S.

While U.S. agricultural exports are continuing to expand, the source of demand for these commodities is shifting. The demand for meat has been increasing rapidly since the 1960s and early in this period, rapid increases in derived demand for soy products and feed grains came mainly from Europe and Japan. Now, the growth in demand is shifting to Eastern Europe, the Soviet Union, and rapidly growing less developed countries. While U.S. exports to developed nations have been growing slowly, if at all, and exports to the Soviet Union and China hinge on grain agreements, exports to less developed countries have increased at a 22 percent annual rate over the past four years. Countries such as Mexico, South Korea, Taiwan, Egypt, Venezuela, Caribbean nations, countries in the Mideast and Southeast and East Asia have exhibited strong increases in demand for U.S. agricultural products. Less developed countries account for three-fourths of U.S. vegetable oil exports, two-thirds of poultry meat shipments, three-fifths of food grains, over two-fifths of the cotton, and a third of the fruits and vegetables.

Increased attention must be paid to market development and economic and political policies in these rapidly developing countries if Illinois export markets are to be intelligently developed. This development has implications for farm organization, the state government, agricultural businesses, and universities. As these countries begin to import more processed agricultural products versus basic grains or oilseeds, the complexity of entering their internal marketing systems increases and must be better understood.

The agricultural supply and service industry within Illinois will also be affected by changes occurring within the world food system. The export of farm products has already spurred a demand by Illinois farmers for agricultural supplies and services. There has also been an increase in the direct export of such supplies by agri-business firms. Again, Illinois is a leading state in farm machinery production, agricultural chemical production, agricultural finance provision, and the production of other major agricultural supplies and services.

The same general needs arise in the further development of agricultural input export markets, as discussed in the output sector. Attention must be given to the rapidly growing less developed countries, their policies, agricultural and marketing systems, and specific farm input and service needs.

One other particular kind of export in demand throughout these rapidly developing countries is that of technical expertise in agricultural development. In many of these countries agricultural enterprises are growing rapidly, and their agricultural leaders are willing to import specific kinds of short- and intermediate-term technical assistance or support training and education of their nationals. Certainly Illinois agri-businesses, farm organizations, and public educational institutions will continue to be involved in meeting these demands.

The rapidly growing less developed countries represent a growing market for U.S. agricultural products, inputs, and services. Technical assistance activities, market development programs, and other agricultural interactions will probably be led by commercial firm participation and state government and farmer organization actions supported by university training, research, public education, and technical assistance activities. The rationale for this involvement is straightforward--the economic self-interest of the people of Illinois is directly involved, and the benefits to both sets of countries seem to be direct and obvious.

Slow-growing LDCs

But what about the slowly growing poor countries such as Bangladesh, Ethiopia, Somalia, Afghanistan, Chad, Mali, and several other sub-Saharan African countries? These countries are not now major customers for commercial agricultural exports from Illinois. Nevertheless, the agricultural development experience of these countries does have major, if somewhat less direct, implications for Illinois.

Today, given the high cost of food production, small world food stocks, major world demands for food imports, and large energy import bills, these countries have little hope of having access to low cost food for times of scarcity or for use as a resource while developing their agricultures into dynamic sectors in the growth process. Food problems are serious in many of these countries. Child mortality rates are 18 times higher than in the more developed countries. In many of these countries the population will double in 20 to 25 years. Investment capital and the institutional and human resources needed to improve their agricultural productivity are limited. Certainly, agricultural institutions in the U.S. and Illinois which are recognized world centers of excellence will have an opportunity to contribute to solving these pressing problems.

There are some direct economic implications for Illinois. Food aid shipments to these countries are often used as a way of assisting in their food security strategies or relieving food import bills which become particularly burdensome where foreign exchange is scarce. Many of these food shipments contain soy and corn products.

However, the major strategy for improving the lives of people living in these countries is by investments in their human resources, development of their institutions, investments in their physical infrastructure, the generation of relevant technology, and the development of appropriate policies. Much of the interaction of Illinois institutions with these countries will be through aid programs supported by the U.S. government, private agencies, or other international aid institutions. While much of this "aid" is returned through payments to U.S. and Illinois institutions, the primary concern and rationale is humanitarian, along with the promotion of political stability. Food problems in the 1980s are

potentially destabilizing forces in international relations. One need only to refer to food problems in Egypt, Kampuchea, Ethiopia, Poland, and the Soviet Union to see the broader implications of conflict resulting from food consumption issues. The temptation to use food as a political weapon will increase as the real prices of food increase in the next few decades. One does not need to look at only African, Asian, or East European countries for examples of pressing agricultural development problems. The future of Mexico's agricultural development will have major impacts on the U.S. Mexico's population will probably double in another 27 years. With over a third of the labor force in agriculture, the need to increase agricultural employment opportunities rapidly is great. This pressing employment problem has already created tensions between the U.S. and Mexico over the entry of unregistered Mexican workers into the U.S., and these pressures are likely to continue.

Many investments to be made through aid programs will be long-run in nature and not attractive to private commercial enterprises. Therefore, the major impacts of these aid programs will be on Illinois' educational and research institutions, private non-profit organizations (such as church groups and development organizations) and technical assistance consulting firms. To be able to participate effectively in these public and private aid programs will require these institutions to strengthen their knowledge and capabilities regarding the agricultural development situation in specific countries and regions, technical skills appropriate for aid programs, and development strategies that work.

The need for agricultural development and increased incomes in these poor countries is great. While there are limits to what can be accomplished through aid programs, intelligent assistance can be extremely productive for the medium- to long-term future of these countries. Because of the substantial expertise represented in Illinois' agriculturally related institutions, the potential for participating in technical assistance activities related to poor countries is great.

SUMMARY AND CONCLUSIONS

With a substantial agriculture sector in Illinois, changes in the world food system are having major impacts in the State. The source of growth in demand for Illinois agricultural products and inputs is shifting from the domestic market and European and Japanese markets to the rapidly growing less developed countries. This change implies shifting our market development strategies toward different sets of countries, understanding the food import needs of these countries, and becoming familiar with their policies and marketing system operations. Direct-hire technical assistance from Illinois consulting companies, private businesses, and universities will be the primary mode for governments and private institutions in these countries to gain access to technical expertise in Illinois. Graduate training in Illinois universities for their students will also continue to be in demand, and providing this offers excellent opportunities to develop contacts in these countries for further business and academic relationships.

The implications to Illinois of the food situation in the very poor, slowly growing countries are more related to universities, private non-profit development organizations, consulting firms, and the general public. Much of the contact with these countries will be through aid programs supported with private funds, federal government expenditures, or international agency support. Again,

these countries are and will continue to look to U.S. universities for graduate education in agriculture.

To take advantage of the opportunities and implications which arise from changes in the world food system will require, in some cases, cooperation among public and private agricultural institutions within Illinois. The internationalization of agriculture which has so rapidly developed in the 1960s and 1970s will certainly continue during the next three or four decades.

Arrangements with universities to help address Illinois agri-business, state government, and private organization needs for expertise in various international subject matter and geographic areas have to be more fully developed. The students now sitting in classrooms will be leaders of institutions in Illinois, the U.S. and other countries, not in the 1980s but in the 1990s, 2000s, 2010s, and 2020s. These students will need understanding to function more effectively in international situations. With a major, growing interest in world agricultural affairs, Illinois agricultural institutions will be better served by graduates such as these. Public education related to international food matters is also important. All of these concerns have implications for developing ways of offering access to language instruction, expertise related to various geographic regions, foreign agricultural and economic policy understanding, and agricultural development expertise.

Given the challenges of changes in the world food system in the context of rising incomes, higher expectations, and persistent hunger, agricultural research agendas are becoming increasingly complex and important. To support technical assistance activities and increased international involvement in agriculture within Illinois and the U.S., international dimensions to research programs are needed. Crop and livestock germplasm exchange, an understanding of major potential disease and pest problems which may be imported, and improved market intelligence information are a few examples of international research dimensions which can produce major benefits to U.S. and Illinois farmers and consumers.

As a land-grant university, the University of Illinois has a commitment to public service. This service orientation extends not only to Illinois and U.S. problems, narrowly defined, but to the vital problems of development throughout the world. These technical-assistance activities not only contribute to alleviating pressing agricultural problems in other countries, they also offer opportunities for college-of-agriculture faculty to gain important international experience. This experience, then, provides the faculty with needed background as teachers for students who will be agricultural leaders in these countries throughout the next 40 years. International agricultural programs also provide the opportunities for international scientific exchange and collaboration which will be increasingly required for progress on complex agricultural problems.

Many of the implications of the world food situation enumerated here were presented as opportunities for the involvement of various institutions within the Illinois agricultural sector. There are implications to the people in Illinois for not taking advantage of these opportunities for involvement: loss of potential markets and profitable investment opportunities; diminished capabilities to implement technical-assistance activities; reduced capacity to offer U.S. and foreign students needed international and development orientations to educational programs; leaders and citizens poorly informed regarding important international issues; and research programs which cannot take full advantage of international

scientific developments. The implications on a broader scale of failure to address major world food problems would involve more severe hunger problems and increased political instability. Whether the rationale for international involvement in alleviating world food problems is primarily humanitarian or the enlightened promotion of self-interest, these implications are not desirable.

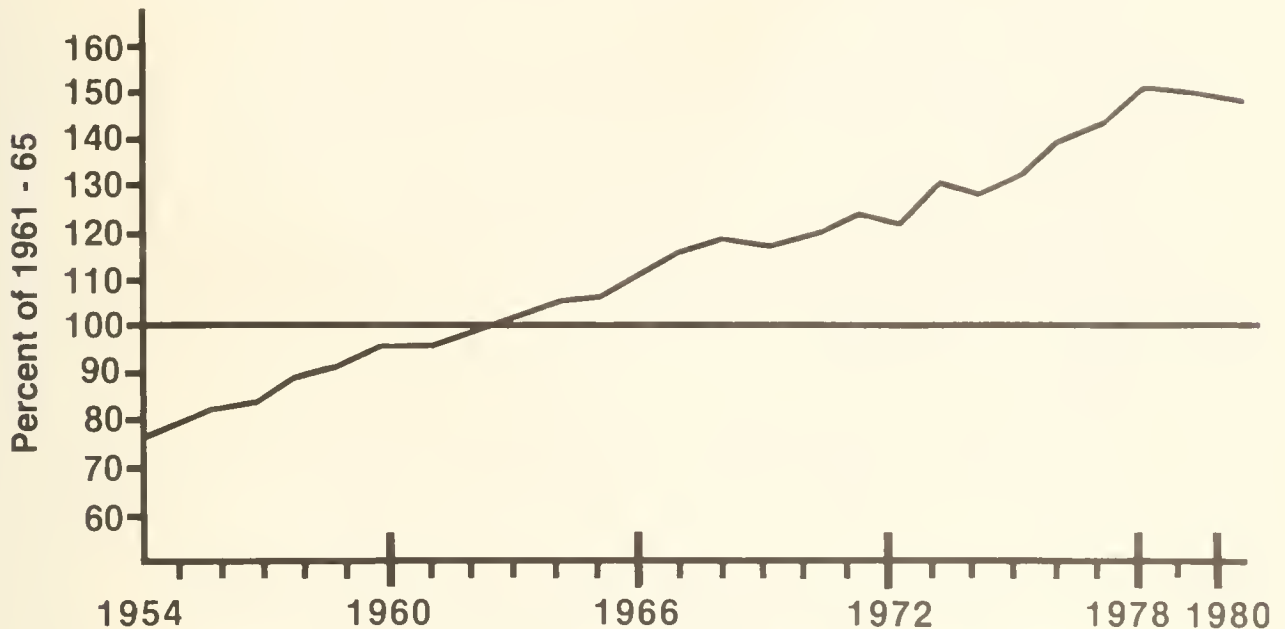


Figure 1. Total World Food Production

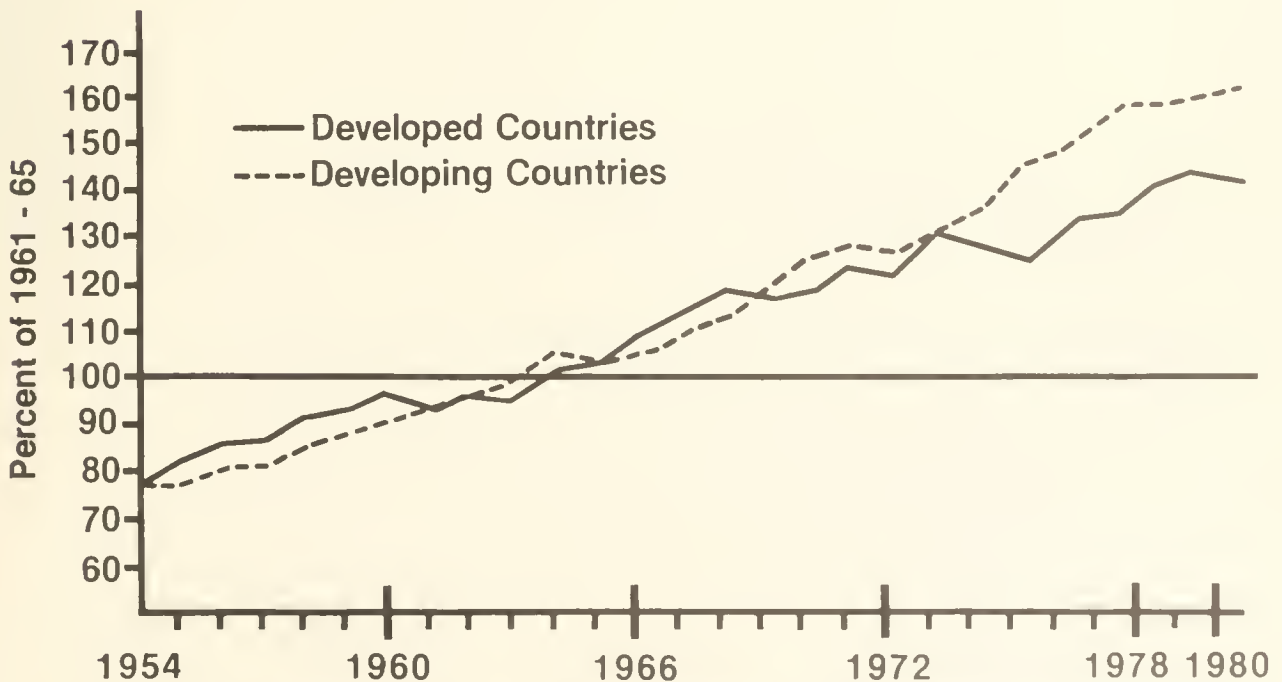


Figure 2. Food Production in Developed and Developing Countries

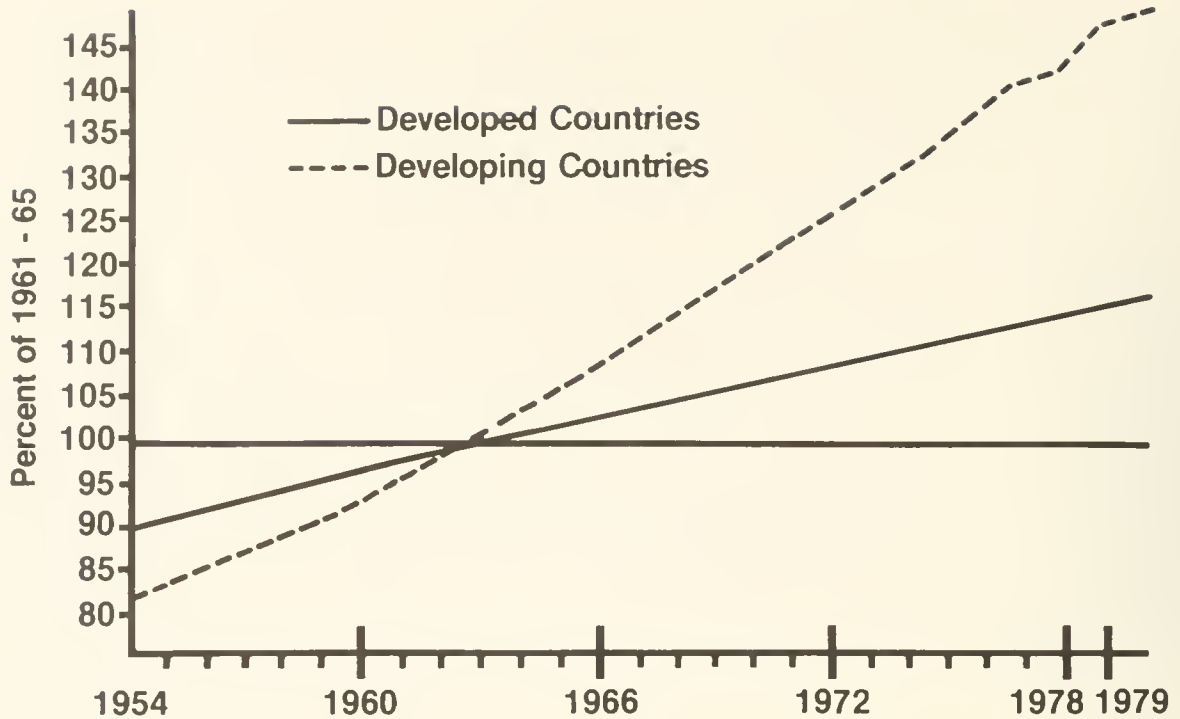


Figure 3. Population Growth in Developed and Developing Countries

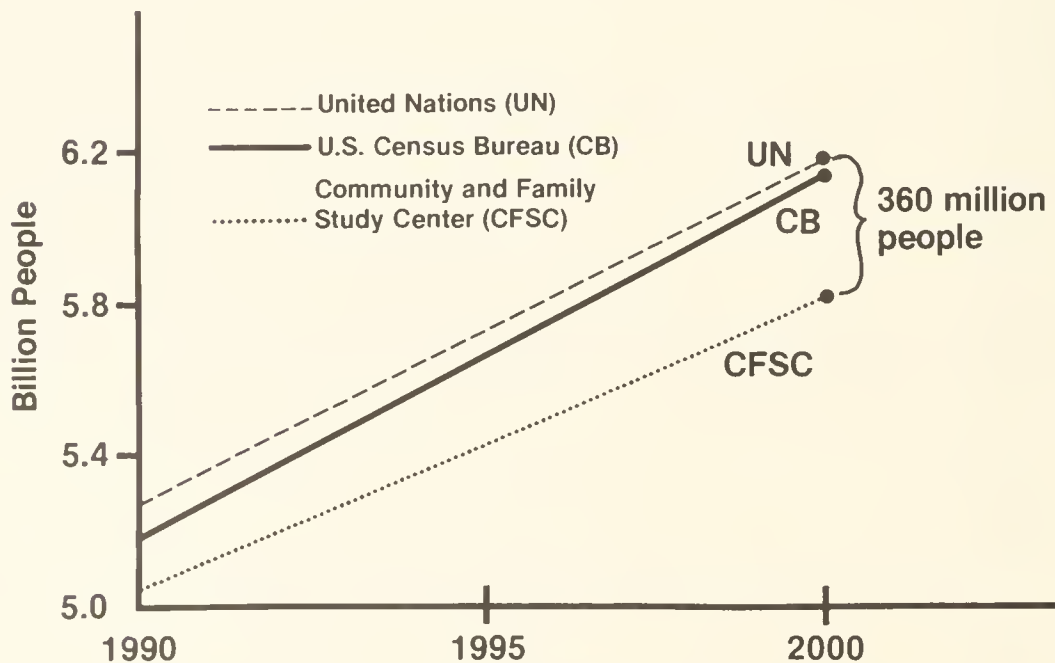


Figure 4. World Population Projections

**Table 1. Population Growth Rates
of World Regions in 1981
and Projected for 2000**

Region	1981	2000
	Percent per year	Percent per year
World	1.7	1.2
Africa	2.9	2.3
Asia	1.8	1.2
Latin America	2.3	1.6
Developed Countries	0.6	0.5

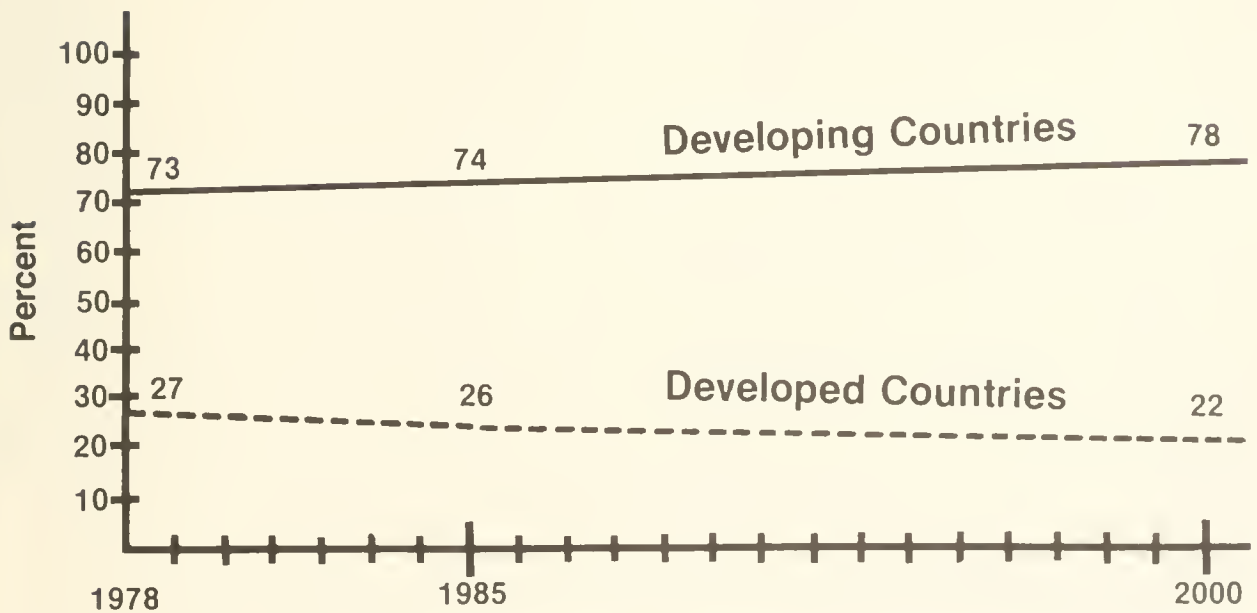


Figure 5. Proportion of World Population

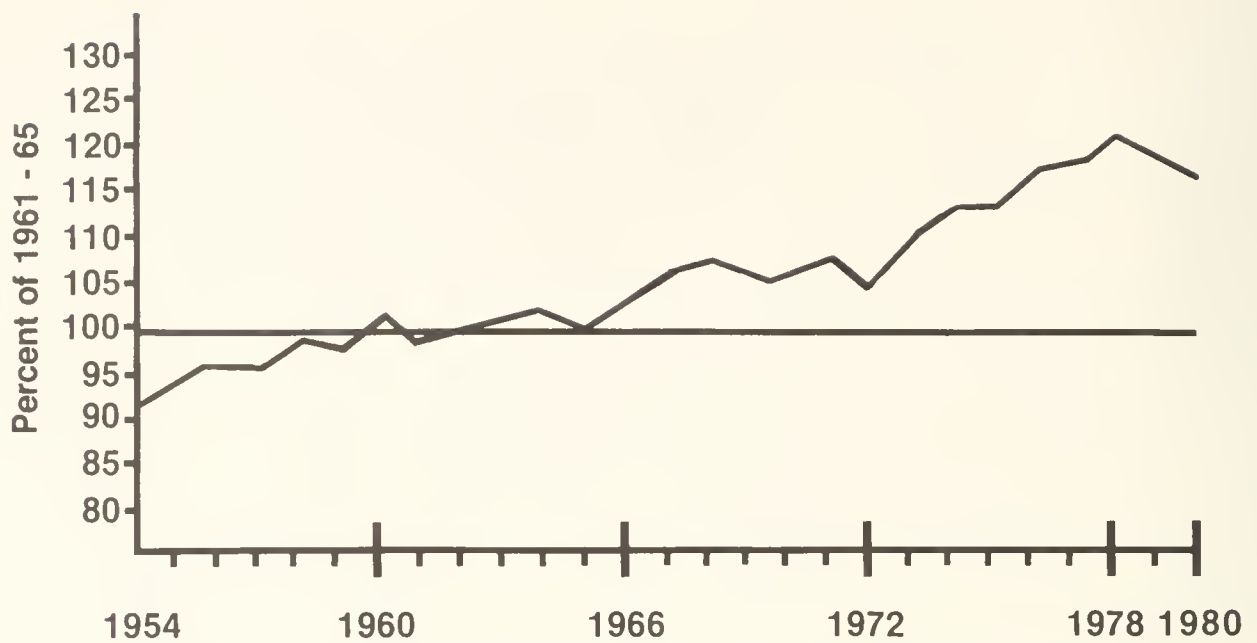


Figure 6. Per Capita World Food Production

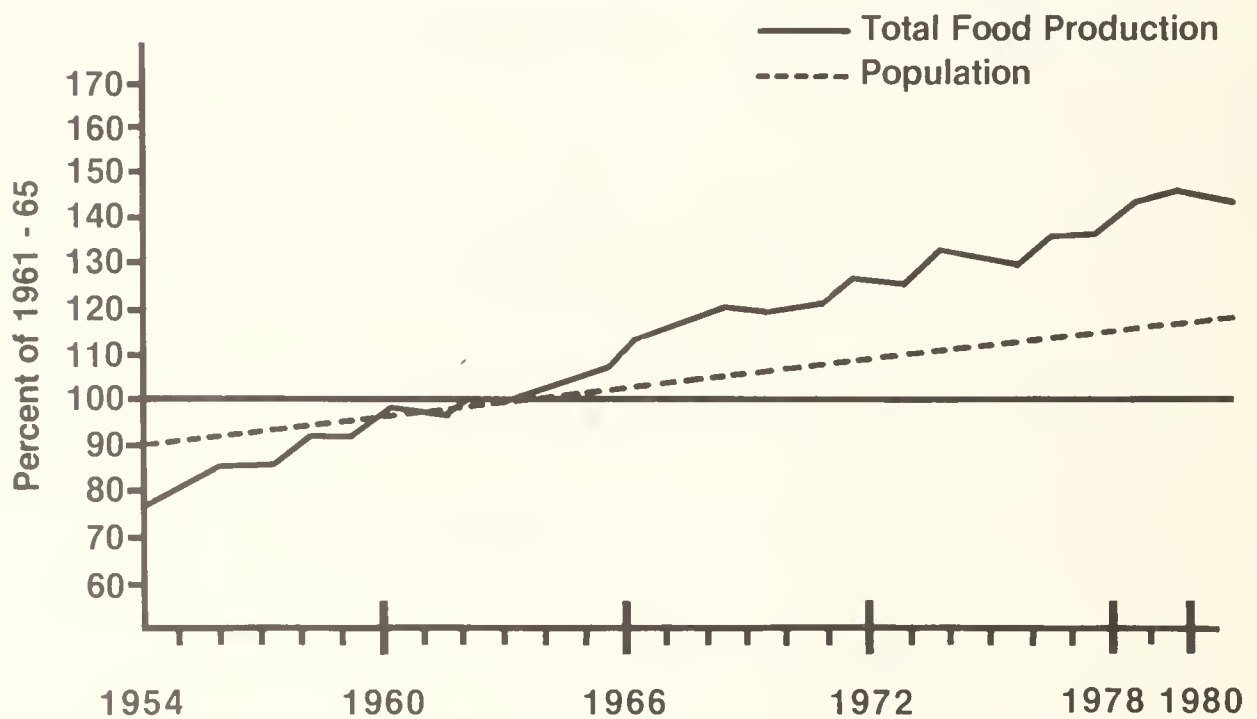


Figure 7. Food Production and Population Change in Developed Countries

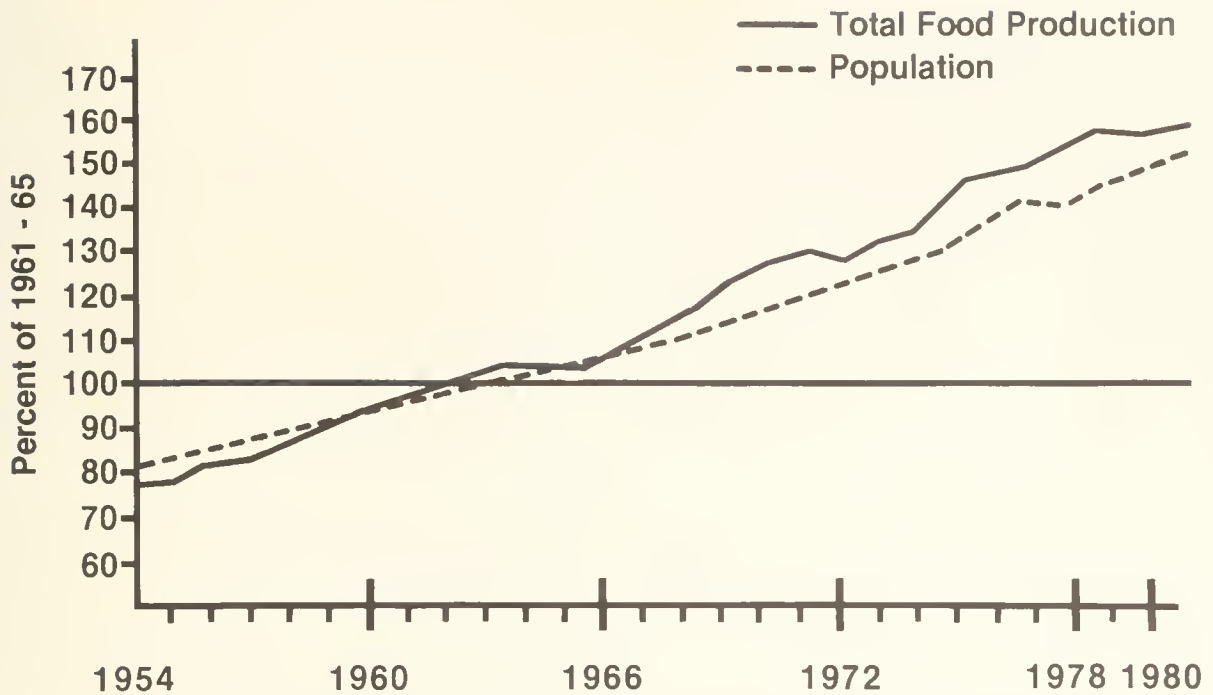


Figure 8. Food Production and Population Change in Developing Countries

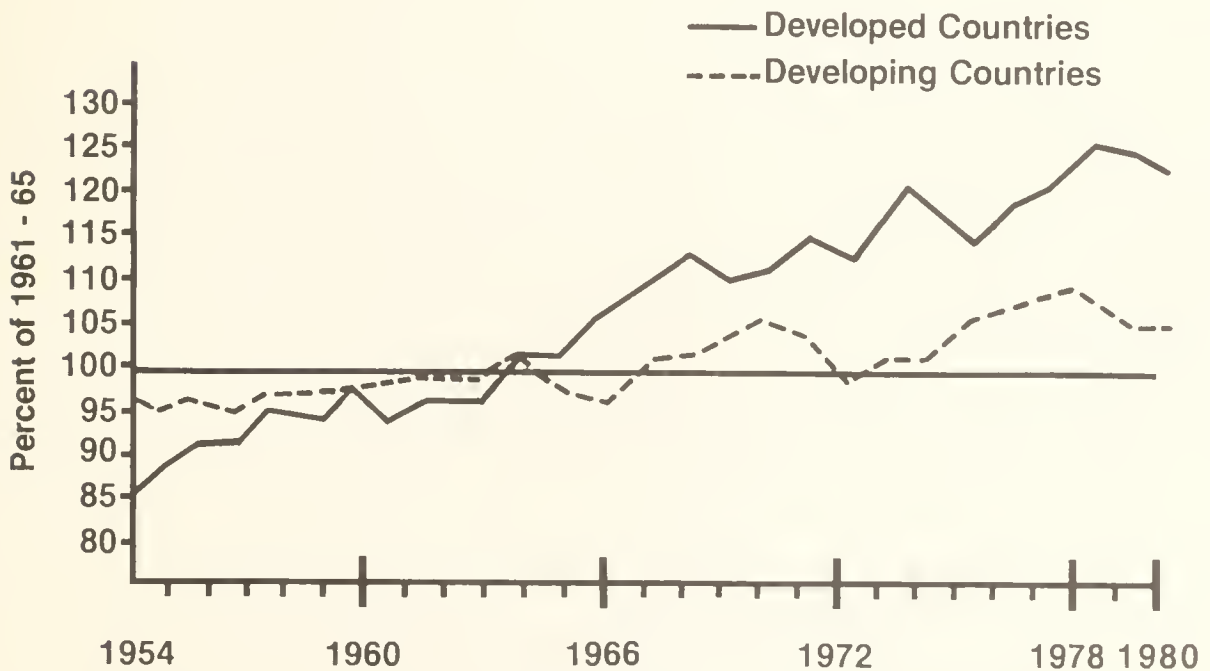
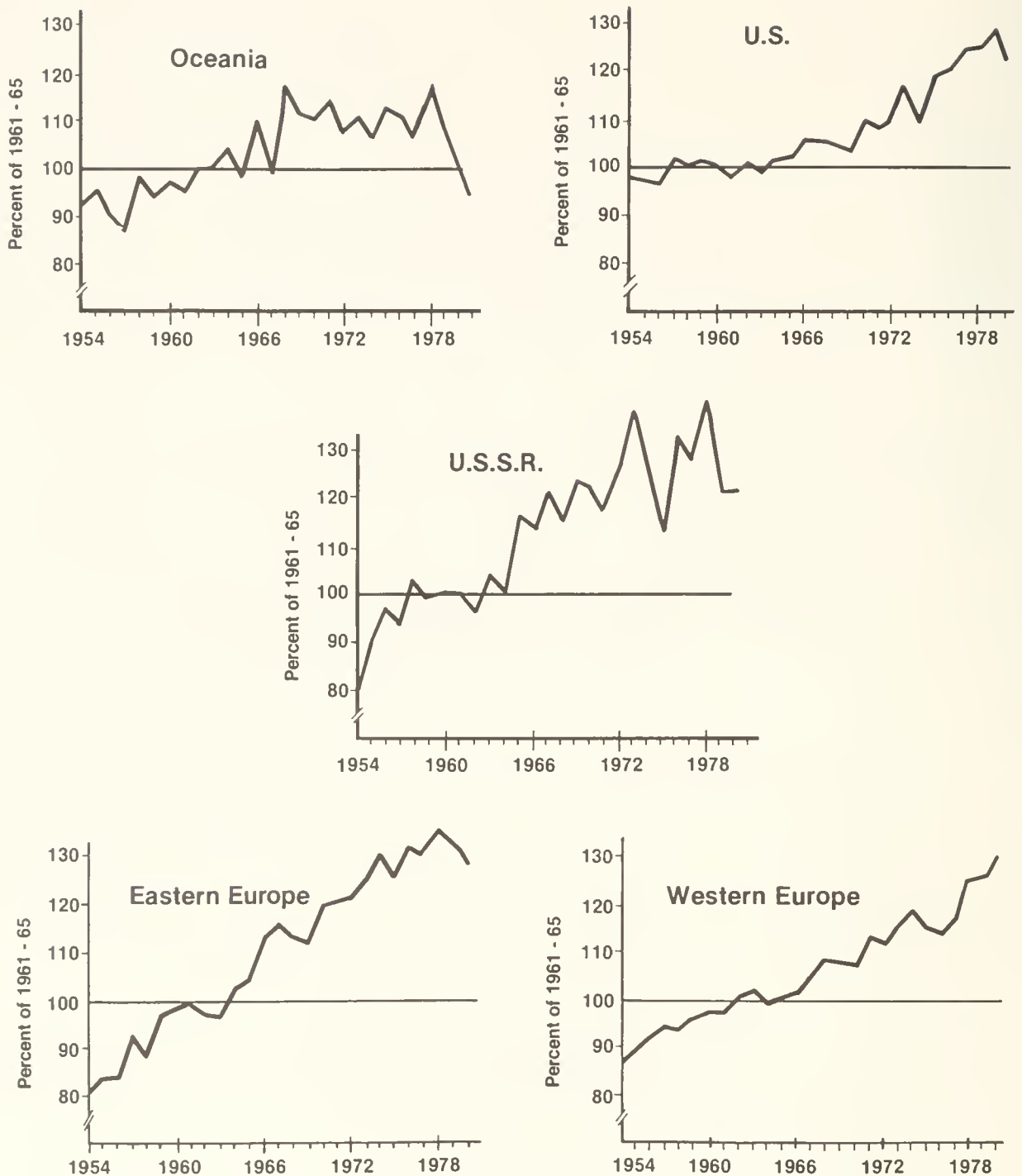
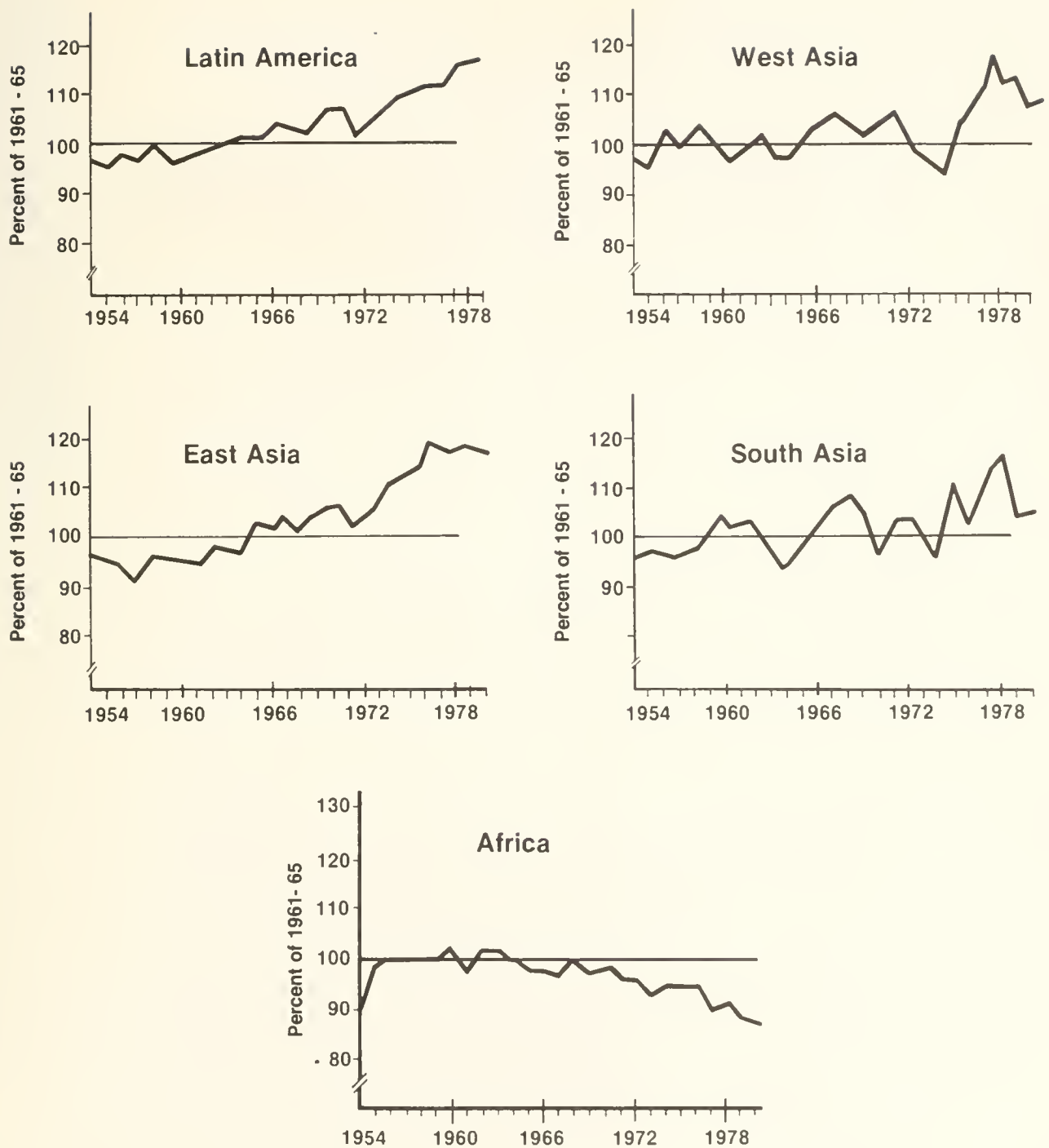


Figure 9. Per Capita Food Production in Developed and Developing Countries



**Figure 10. Food Production Per Capita:
Developed Regions**



**Figure 11. Food Production Per Capita:
Developing Regions**

Table 2. Average Per Capita Daily Food Supply by Region

Region	Protein		Calories as % of Requirement	
	1961-63	1972-74	1961-63	1972-74
	(Grams Per Capita)			
Developed Countries	91	98	124	132
Developing Market Economics	53	54	92	95
Africa	52	53	89	91
Latin America	64	65	101	107
Near East	63	65	93	100
Far East	49	49	91	92
Asian Centrally Planned Economies	54	63	83	97
World	65	69	101	107

Table 3. Estimated Number of Persons with Food Intake Below the Critical Minimum Limit

Region	Percent Below Minimum		Total Number Below Minimum	
	1969-71	1972-74	1969-71	1972-74
	(Percent)		(Millions)	
Africa	25	28	70	83
Far East	25	29	256	297
Latin America	16	15	44	46
Near East	18	16	31	20
Developing Countries	24	25	401	455

The Role of the U.S. Government in Developing a World Food Strategy

Leo V. Moyer

I certainly appreciate the opportunity to discuss the role of the U.S. Government in world food strategy affairs. The policies of the present Administration are designed to achieve a strong economy at home so the United States can continue to respond to world food needs, thus maintaining U.S. leadership in world agricultural affairs. This response is not a sudden new commitment on the part of the United States, but rather a continuation of a long-term commitment--unmatched in the history of nations--to combat hunger and malnutrition in the world.

President Reagan reaffirmed these commitments in a concrete way last October at Cancun, Mexico, when he met with other world leaders, who together represented two-thirds of the world's population. The President charted a strategic course for global economic growth and development for all nations through the strengthening of the relationships among both developed and developing countries. In the summer of 1981 President Reagan announced plans--in coordination with other donor countries--to develop a Caribbean Basin Initiative that will assist in the economic development of countries in that region.

In May Secretary of Agriculture Block participated in the World Food Council Meeting in Yugoslavia in pursuit of one of mankind's most cherished goals--the elimination of hunger throughout the world.

LONG-TERM U.S. COMMITMENT TO COMBAT HUNGER

The American Government and the American people have a deeply rooted, long-term commitment to combat hunger and malnutrition throughout the world. The United States developed a strategy of bilateral food aid as early as 1954. Since that time, the U.S. has contributed almost \$32 billion in food aid to needy nations. This contribution amounts to more than that of all other nations combined.

And the United States is also one of the founders of the World Food Program, which was established in 1962 under the auspices of the Food and Agriculture Organization and the UN General Assembly. A significant portion of the food aid provided by the United States moves through this and similar programs. In fact, 34 percent of U.S. food aid moves through the World Food Program and UNICEF; 52 percent through the voluntary non-profit U.S. agencies, such as CARE and many church organizations; while only 14 percent is handled through government-to-government programs.

Leo V. Moyer: Associate Administrator, Foreign Agricultural Service, U.S.
Department of Agriculture, Washington, D. C.

However, food aid is only one avenue of our total assistance to developing countries in the fight against hunger and malnutrition in the world. The United States has provided a substantial sum--more than \$50 billion, in fact--in economic assistance in the past decade alone.

It is unfortunate, however, that we must measure aid in dollars rather than in lives--and health, happiness, and hope. These are the true measures of aid.

Recently President Reagan graphically stated the U.S. commitment to--and position on--world food security before the World Affairs Council of Philadelphia, a week before he went to Cancun. He said, "There is a propaganda campaign in wide circulation that would have the world believe that capitalist United States is the cause of world hunger and poverty. And yet each year, the United States provides more food aid assistance to developing countries than all the other nations combined. Last year, we extended almost twice as much official development assistance as any other nation."

LONG-TERM WORLD FOOD OUTLOOK

In looking at the long-term outlook for world food production, there can be little doubt that a strengthening of the world food strategy is needed. We expect alternating periods of short supplies and surplus production with a gradual trend toward tighter world food balances during the next two decades. The major factors contributing to this development will be growing populations, a growth in demand triggered by increased income in the petroleum exporting countries, and rapid strides in income growth for countries such as South Korea and Brazil.

Population growth in the low-income developing countries, while moderating slightly, will still consume most of the advances in their agricultural production. Therefore, the long-term solution to this global growth in food demand is to increase the productivity of agriculture worldwide, and to increase purchasing power in those countries that cannot produce enough food to meet their own requirements. Our domestic and international policies are designed to accomplish this goal.

U.S. AGRICULTURAL POLICIES

At this time, I would like to review briefly for you the agricultural policies of the Reagan Administration.

Our policies are designed to maintain a strong economy at home and to keep the United States an active and responsible participant in world agricultural affairs. As world population continues to increase, and the demand for food and agricultural products rise, the United States seeks to remain a dependable supplier of food and agricultural products to both developing and developed nations.

Our domestic farm policies seek a balanced level of production, one that will maintain farm incomes, help meet world food needs, and conserve our productive

resources for future generations. As a result of two successive record U.S. wheat crops, a record 1981 corn harvest, and the largest cotton crop since 1953, Secretary of Agriculture John R. Block recently announced a reduced acreage program for these three commodities. At the same time, the Secretary pointed out that the reduced acreage program--coupled with an aggressive export program--will strengthen prices in the coming marketing year.

Besides short-term measures to maintain a strong farm economy, we are also taking steps to maintain long-term productivity, both at home and overseas. We will continue to supplement our domestic research with cooperative international research programs, and to exchange scientific information with developing and developed nations. All nations and their people benefit from these research activities and exchanges. Research will increase agricultural productivity; it will also reduce post-harvest losses and increase food-processing efficiency.

Although the United States is the largest food producer, we still do not produce all we need of many important agricultural commodities. We will continue as a leading market for large amounts of commodities from developing countries. In 1980 we imported \$17 billion of agricultural products, almost \$12 billion of which came from developing countries. That year the United States was the world's second largest importer of agricultural products--ranking behind West Germany. Import totals for Japan and the Soviet Union came close to the U.S. level.

U.S. AGRICULTURE'S ROLE

There is a common tendency, when considering world food security, to overlook the role of commercial trade and to forget that many developed countries as well as the developing must look beyond their own shores to meet their food requirements. Japan, for instance, is dependent on imports for more than half of its caloric intake. Another example is the United Kingdom, likely never to be self-sufficient in food. Other industrial countries--the Soviet Union, for example--depend increasingly on trade to meet food requirements. As you are well aware, American exports of farm commodities have increased dramatically over the past decade in response to the increasing food demand in all countries, developed and developing. World grain trade increased by more than 100 million tons during the 1970s and three-fourths of that increase was supplied by American farmers.

A significant factor in this dramatic growth in trade has been the rapid emergence of the developing world as a commercial market for U.S. agriculture. In recent years more than one-third of U.S. farm product exports went to developing countries, and in 1981 that share approached 40 percent--out of a total export market of almost \$44 billion. Ninety percent of U.S. exports to developing countries are commercial sales and less than 10 percent are moving on concessional terms. Ten years ago 50 percent of U.S. exports to developing countries were on a concessional basis. Overall, less than 10 percent of U.S. farm exports were concessional last year--down sharply from a decade ago when 50 percent of U.S. agricultural exports were concessional sales.

There are many examples of developing countries in which food production has increased substantially. These include India, Pakistan, Bangladesh, Philippines, Malaysia, and Brazil. On the African continent, we note the development of Cameroon and Niger. In each case, those countries have given priority to their

food and agriculture problems and have provided incentives for farmers to produce more.

U.S. TRADE POLICIES

U.S agricultural trade policies are directed at an expanded and liberalized exchange of commodities in the world market. These policies include efforts to reduce trade barriers in all countries, foreign access to U.S agricultural products on an open and equal basis, and some expansion of U.S. export credit programs.

We believe that nations should cooperate in reducing trade barriers that work against the efficient production and distribution of farm products. We are concerned about increasing protectionism in parts of the world and urge that all countries exercise vigilance to avoid measures that would hamper trade growth in the future.

We are concerned by measures increasingly taken by some countries to insulate and stabilize their food supply at the expense of the orderly movement of trade. Such devices as variable levies and subsidies tend to destabilize prices and supply availability in third countries, and this price instability falls hardest on low-income countries, with the neediest countries suffering the most. Needless to say, these devices make it more difficult for U.S. farmers to export agricultural products on a competitive basis.

We will continue to encourage other nations to remove these artificial barriers to trade and to let the market work for the benefit of all. Our message to our trading partners has been clear: the United States intends to compete vigorously and fairly in the world market, and it expects other countries to do the same.

Our emphasis in trade development is focusing increasingly on the developing countries. This type of effort in the past has succeeded in sharply increasing U.S. agricultural exports to targeted countries.

Japan in the distant past, and Korea and Taiwan more recently--commercial markets worth billions of dollars to U.S farmers--are notable examples of what judicious use of Public Law 480, export credit, and cooperator market-development projects can do.

In this new effort we are concentrating first on countries in Latin America and North Africa and also on China. Recently we sent grain trade missions representing both government and private enterprise to those regions to assess their needs for grain and to offer assistance in meeting them. These missions were highly successful, and we will encourage future exchanges of marketing professionals with these and other regions.

In addition, there are other types of U.S. assistance for a world food strategy.

U.S. FOREIGN ASSISTANCE

It is increasingly clear that the economic and agricultural development assistance provided by the United States to developing countries has helped to move them close to the mainstream of the world food economy.

Obviously, the P.L. 480 program of food assistance contributed to world food security beyond the humanitarian aspect represented by the 290 million metric tons of food supplied to needy people during the 27-year history of the program.

P.L. 480--or the Food for Peace program--is the primary means by which the U.S. Government provides food assistance to other countries. Since its inception in 1954 nearly 300 million tons of commodities, valued at \$32 billion, have been exported through P.L. 480 programs. The major commodities include wheat and wheat products, corn and corn products, sorghum, rice, nonfat dry milk, and soybean oil.

P.L. 480 authorizes three programs for providing food assistance. Under Title I, the U.S. Government provides loans to developing countries on concessional terms--low interest rates and long repayment terms--for the purchase of U.S. agricultural commodities. Food supplied under Title I has been the largest component of P.L. 480.

As Congress intended, P.L. 480 has served multiple objectives--market development for U.S. commodities, support for economic growth in poor countries, emergency feeding of the hungry, and support of U.S. foreign policy goals. We intend that it continue to do so. Title I has been used to meet all four legislative objectives in varying degrees.

For American agriculture, the Title I program serves as an important mechanism to develop and sustain export markets for our agricultural commodities.

In 1977 Congress authorized a new "Food for Development" Title III program. Title III programs operate in tandem with Title I programs. But Title III programs provide for forgiveness of the original Title I loan if the recipient country uses local currencies to implement programs in nutrition, health services, and population planning.

Title III programs are multiyear--between three and five years--and are targeted toward the poorest of the developing countries. Agreements have thus far been signed with the governments of Bangladesh, Bolivia, Egypt, Honduras, Senegal, and Sudan.

Title II, the other program authorized by P.L. 480, provides donations of food to meet famine or other urgent relief requirements, to combat malnutrition, and to promote economic and community development. Donations are made through U.S. private voluntary agencies, the World Food Program, and government-to-government agreements.

A major priority for Title II food donations is to help meet the nutritional needs of vulnerable groups in recipient countries. Generally, programs emphasize mother-child health activities, but also include school feeding and food-for-work projects.

To complement its food aid programs, the United States now has a 4-million-ton wheat reserve, established in January 1981. The reserve was created to ensure that wheat would be available for the P.L. 480 program to meet urgent humanitarian food needs in developing countries, even if domestic supplies are tight. Up to 300,000 tons of the reserve may be used for unexpected emergency situations. The reserve will also help to ensure that the United States can meet its annual pledge of 4.47 million tons of foodgrains to the Food Aid Convention.

OPERATION OF FEDERAL FOOD AID PROGRAMS

Decisions on Title I and Title II programming for such issues as country dollar allocations, financial terms of such agreements, and self-help measures are made by the inter-agency Food Aid Subcommittee of the Development Coordination Committee. The subcommittee is chaired by the U.S. Department of Agriculture (USDA). Voting members include the Departments of Agriculture, State, Treasury, and Commerce, the Agency for International Development (AID) and the Office of Management and Budget. Each voting member has one vote and decisions are made by consensus. In cases where a consensus cannot be achieved, issues are directed to higher councils of government for resolution. While these issues are generally resolved at the Cabinet or sub-Cabinet level, in some instances a Presidential decision may be required.

U.S. INVOLVEMENT IN SCIENTIFIC AND TECHNICAL PROGRAMS

One of the U.S. policy goals is to stabilize world food supplies through the effective use of science and technology. USDA carries out scientific and technical exchange programs with more than 30 countries. Last year, cooperative agreements were signed with Argentina, Chile, Hungary, Romania, and West Germany.

U.S. participation is based on the selection of those programs which benefit the American farmer as well as the host country, such as exchanges of germplasm with China, Mexico, and other countries to develop better strains of soybeans, wheat, and other crops. Our scientists have brought back collections of parasites in the effort to expand biological measures to control targeted insect pests and weeds.

Technical assistance is also provided to developing nations as part of the U.S. commitment to combat hunger and malnutrition. USDA has entered into more than 125 agreements with AID, international organizations, and governments of other nations to carry out technical assistance programs in 54 nations.

These activities benefit not only the U.S. economy, but also U.S. farmers and consumers. As the standard of living of a developing country rises, so do the expectations of its people for better food and other products. As I pointed out earlier, a decade ago approximately 10 percent of U.S. agricultural products were purchased by developing nations. Today, that figure is nearly 40 percent. We are also building better relations with developing countries as a result of our development assistance efforts.

INTERNATIONAL ORGANIZATIONS

As you know, there are many international organizations concerned with food and agricultural problems. The U.S. is an active participant in these.

In May 1981 Secretary Block led the U.S. delegation to the World Food Council meeting in Yugoslavia, which provided the forum for about 40 Ministers of Agriculture to meet and share concerns, ideas, and proposals for world food security.

In June 1981 Under-Secretary Seeley Lodwick led the U.S. delegation to the Council meeting of the UN Food and Agriculture Organization (FAO) in Rome. The purpose of the U.S. participation at the FAO meeting was to join with other nations in furthering world food objectives.

The United States works closely with international agricultural organizations to make certain that U.S. interests as a world leader are represented in shaping world food and agricultural policies and are also coordinated with those of other nations.

Besides the World Food Council and FAO, the United States has a working relationship with the Inter-American Institute for Cooperation in Agriculture (IICA) and the Organization for Economic Cooperation and Development (OECD).

Food and agricultural development are basic to the economic growth and political stability of developing nations. The total assistance provided by international organizations to nations in need now exceeds \$5 billion annually. This amount is now several times more than the United States contributes to bilateral development programs in this sector.

WORLD FOOD SECURITY

The world's food security has significantly improved over the period of 1973/74 to 1981/82. The overall level of world grain reserves has improved, and major developing countries such as India and Bangladesh are in a better situation with respect to food production and stocks. But we recognize that food supplies remain precarious for millions of people daily, and that there are no simple solutions to remedy the problem.

The point should be made, however, that this situation is not primarily the responsibility of donor countries or the international organizations they fund. The responsibility lies first and foremost with individual governments, which must take the steps necessary to improve food balances for their people. Improved food balance may come through more internal production in some cases or, in others, through improved prospects for trade. Both cases will require careful planning and intensified actions on the part of governments in food-short countries.

U.S. VIEWS ON WORLD FOOD SECURITY

The United States believes that it has set a positive example in the long search for world food security. Our agricultural policies emphasize production for export and an open market system providing full access to foreign buyers. We feel that our marketing system is responsive to world market changes.

Furthermore, we feel that the United States is unique in having developed reserve policies designed to meet domestic objectives and international needs--commercial and concessional commitments. The Food Security Reserve of 4 million tons of wheat backs our food aid commitments. The farmer-owned reserve contributes in a very important way to world market stability and supply assurance. Through both bilateral and multilateral programs we provide food aid and encourage increased production in deficit countries.

We recognize, however, that the United States alone cannot assure world food security. We believe, therefore, that other countries should establish their own national food reserves. Other exporting countries should develop reserve policies to help assure world food supplies instead of relying on annual crops to support exports. Developing countries, to the extent possible, should also establish their own national reserve policies.

The United States repeatedly has stressed the importance of all countries developing their own programs of improved food security. We have offered to provide assistance to improve food production, to share our knowledge on techniques for stockpiling of food reserves, and even to make available supplies for other countries to establish their own stockpiles. We will continue to stand ready with offers of assistance, but the crucial first steps must come from the countries themselves.

Meeting World Food Demands through Exports

Benefits to the Farmer

Willard Severns

I want to express my appreciation to the University of Illinois for taking the leadership in establishing this conference on understanding the world food system and its importance to Illinois and the nation. The excellent attendance at this meeting indicates that there are not only many people who are concerned with these issues, but also that there is a willingness to listen to the views of others and exchange ideas so that we can move forward together in a more productive effort.

In the brief time that has been assigned to me, I would like to give you my perspective as a farmer on the topic of "Meeting World Food Demands Through Exports: Benefits to the Farmer." Although my comments will certainly not be all-encompassing of the many issues at hand, I do hope that they will highlight what I see as the major areas of concern and provide us with the opportunity to explore some of the challenges and opportunities facing us in the last two decades of the 20th century.

In order to set the stage, I would first like to establish my conviction that trade is, after all, only trade. All too often we fall into the trap of talking in terms of foreign trade and domestic trade. I would submit to you that one of the biggest obstacles we all face in meeting world food demands is the tendency to talk about our non-U.S. customers as being "foreign," and in some cases, secondary customers. Part of the reason, of course, is the fact that the U.S. market is and has been our biggest market, and many of us have simply not thought in terms of exporting. In recent years agriculture has made a greater shift away from this provincial attitude than other sectors of our economy, but we all have a long way to go. There obviously are some commodities which the United States can produce better and more economically than others. By the same token, there are many commodities which are produced much more competitively in other countries than they are in the United States. While there has been great progress through the multilateral trade negotiations in reducing some of these barriers, there is still great opportunity for the United States and other countries to continue working to establish a better climate for a freer and more open world trade community. It simply will not be possible over the long term for the United States to continue a philosophy that encourages full-scale development of agricultural production and exports while at the same time attempting to restrict the importation of manufactured goods or even other agricultural commodities.

Willard Severns: Farmer, Moweaqua, Illinois.

To be able to sell our goods and services in other countries, agriculture must make the necessary investment at all levels to identify the needs of our potential customers. We can no longer simply produce for our own markets and then try to move our excess production into another market. We must identify what others want and then produce for their needs. The easy route, of course, is to say, "I will produce what I want, the way I want to, when I want to do it and in the quantity that I can manage," and then say to our government or our commodity organizations, "OK, now you sell it." To continue down this avenue for the long term will certainly mean that our competitors will replace us in the marketplace. A number of organizations, such as the American Soybean Association with which I have been associated the last few years, have been working aggressively with their own funds and with the Foreign Agricultural Service for the last 25 years in seeking out and identifying new market opportunities. Since the late 1950s we have seen soybean production expand by over 50 million acres, and today over 50 percent of the entire crop is exported either in the form of whole soybeans or soybean products. In fact, U.S. soybean farmers now export more of their crop than they grew in total in 1969. This increase was no accident. It is the result of a lot of hard work and long-range planning, coupled with aggressive funding and innovative market development programs. In summary, we have to identify our market and then produce for that market.

Within the last few months we have heard more and more discussion about the need to sell "value-added" products. This concept simply means that we need to sell more finished or processed products and less raw material. Certainly, this concept has a lot of appeal, and there is no doubt that it can be very beneficial to our economy. In fact, for soybeans we are already exporting between 35 and 40 percent of our crop as value-added commodities, primarily soybean oil and soybean meal. Other value-added products, such as poultry, pork, soy flour and textured soy protein, are important export commodities in the value-added category. We do, however, need to raise a caution flag in this area since there are many countries around the world which have very definitely stated national policies that prohibit or severely restrict the importation of significant amounts of value-added commodities. Their reasoning is the same as those who propose value-added exports from the United States. They simply want to buy raw products so that they can stimulate their own economy and provide employment for their own labor force. One such example would be the Philippines, which has only a 5- to 10-percent duty on soybean oil, meal, and beans, but a 55-percent tariff on poultry. There is no doubt that we can do a better job of promoting value-added commodities in all sectors of our economy, but I believe it would be a serious mistake to think that we can legislate such an export policy or devote our efforts to export expansion only in the area of value-added products.

Although there are many important factors, there is one essential ingredient if we are to be successful in expanding agricultural exports. It behooves all of us to make the best possible effort in supplying the highest possible quality product at competitive world prices. Several years ago we experienced a serious loss of market share in soybean meal due to concerns over quality. Our largest competitor in the world market, Brazil, made a concentrated effort to supply a quality and quantity of soybean meal that our soybean industry was apparently unable or at least unwilling to provide.

This situation was coupled with an aggressive development effort by Brazil and also, I might add, some questionable export incentives which allowed our competition to displace a large portion of our market.

My preceding comments lead me to the next point, one of the most significant issues we must address: the area of export credit. If we are to meet the world food demand, it will be increasingly important for us to provide a realistic and dependable credit support system for our sales efforts. There are many examples over the past two or three decades that clearly prove the value of a credit program. All of us rely on credit in some fashion to operate our businesses or our households. The same needs exist in worldwide trade. Many countries that have used our credit in the past have now developed their economies in such a way that their credit is short-term or they are on a cash basis. The new farm bill now provides for a new concept in export credits. It is called a revolving credit fund. In its simplest terms, this means that money is appropriated by the Congress to establish export credit and when the loans are repaid, the principal and interest go back into the fund to be available for future credit needs. It should also be noted that these loans are made at the prevailing cost of money to our government, plus handling charges, so that the net effect is and has been that the loans make money for the U.S. government. One of the problems has been, however, that in the past these funds have been appropriated by the Congress, so that when they are repaid, they go back into the U.S. Treasury. It appears that the funding has been a net expense to the federal government. This new concept would establish the fund as a self-sustaining operation. Another obstacle to this innovative new approach, quite frankly, has been the attitude of our elected officials in Congress, who want to maintain control of the process. I think all of us need to challenge the thinking of these individuals. While the fund has been authorized in the farm bill, no funding has been appropriated by Congress.

During some of the earlier presentations, several speakers have stated that perhaps we are mining our soil and natural resources for short-term gains through exports. I will be the first to add that there are undoubtedly problems that we need to deal with. While some of the issues are overstated, there are, in fact, serious problems in some areas of the country. This is not a quick-fix matter, and it needs the conscientious and careful attention of us all. I would submit to you in this discussion, however, that the biggest contributor to this situation over time has been low commodity prices. Farmers have been forced to maximize the use of their land in order to survive. I firmly believe that it is possible for farmers to conserve our valuable natural resources while at the same time meeting world food demands. While there are those that claim that food is too expensive, I would simply say, take a look around. Food is not only a good buy here in the United States, it's downright cheap compared with almost every other place in the world. If we are going to maintain our cheap food posture in U.S. agriculture, then perhaps some other way needs to be found to help farmers conserve and maintain our long-term productive capacity and natural resources. In recent years, research and investment incentives in our production capacity have been de-emphasized. Both of these are essential to a long-term successful effort in maintaining and preserving our competitive edge in agricultural production for the long term.

Perhaps the single most important factor that will allow us to meet world food demands through exports lies in the hands of the farmers themselves, the managers. The management of scarcer and more expensive inputs will be the key to success for U.S. farmers in the future. Management has made the difference between success and failure for many farmers, and has become especially crucial in the last 10 to 15 years. The number of farmers continues to decline and a year like this one dramatically emphasizes the importance of good management. More and more, farmers are becoming aware that marketing and good management are what it takes to stay in business. While the coffee-shop talk still centers around the price per bushel, every good farm manager knows that the real benchmark to his survival is net profit per acre.

While I have alluded to the role of government earlier in my comments, I would like to emphasize the importance of this part of the equation, if we are to meet world food needs. We all need to work very closely with our government at all levels to establish a basic policy in the current and future administrations that will give us a clearly stated set of objectives. It is essential that we create an awareness of the urgent need to develop our agricultural trade more fully. It would be refreshing and encouraging to see an aggressive effort made to reduce barriers to trade, such as the beef import quotas in Japan. The United States clearly has a competitive advantage, and it is high time our government made a serious and major effort to facilitate a meaningful and workable export policy.

Almost all of the major trading nations in the world take a more serious and long-term view of trade. They have established permanent offices, with officials who add continuity and longevity. In the U.S. we bounce from administration to administration; politics is the guidepost. Consequently, when we sit down to talk trade issues, we have neophytes dealing with seasoned professionals of other countries, in most cases. This situation should be changed.

Much controversy has been precipitated by embargoes on our agricultural exports. It would appear to me that the question is not whether or not the United States plans to use food as a weapon or a diplomatic tool, but rather one of how we in agriculture will deal with the matter. My personal feeling is that food is, in fact, a weapon, and therefore it is essential that we develop some rules so that we all pay the cost when that weapon is used, just as we do for a Phantom jet fighter. No single commodity and no single segment of our society should be forced to pay the cost of this political decision.

It is all too easy for politicians and bureaucrats to talk about "their" food without having to suffer the economic consequences of their actions. Such discussions also take the form of government marketing boards and bilateral trade agreements to "protect the interests of the United States" without any real concern over the impact of a policy on the agricultural community. I would simply ask, does it make sense to sign an agreement with China and Russia and then tell the Japanese, our best agricultural customers, that they don't need one? Before our government gets too far down the road in deciding who we can sell to, and how much, I think we need to see where the policy could lead us.

I would like to quote an editorial excerpt from the St. Louis Post Dispatch of January 3, 1981. "To use those exports (food) in a time of tight grain supplies and rising prices may require establishment of a government role in export decision making. Should the predicted worldwide shortages materialize, a hands-off policy by the government could mean that international demand would drive U.S. food prices far beyond what is required to ensure farmers a fair return they deserve. But if exports are limited, should the grain companies or the government decide who can buy?" Isn't it interesting to compare the concern of a year ago over short supplies after a problem with Mother Nature to the present-day situation, when we're wondering what we're going to do with all of our agricultural production? I would simply say to you and others who discuss this question of how much we should produce and who we should sell it to, that the problem is far too complex to replace it with a government computer. My personal observation is that while the free market system is certainly imperfect, at best, it is still far better than any alternative or man-made solutions that I have seen. One interesting point in the editorial which I just quoted is the conjecture about food prices going far beyond what is required to ensure farmers the fair return they deserve. I can't help but wonder whose definition will be used in determining a fair return and who deserves it. My guess is that the Post Dispatch editorial staff wouldn't want farmers determining their salaries!

If the United States is to continue to excel in agriculture and if we are to meet world food demands through our exports, farmers and our total economy will benefit most if we are successful in: 1) having less government, not more; 2) adopting a policy of productivity, not protectionism; 3) seeking a free market, not a government market; and 4) welcoming competition, not a guarantee.

In summary, then, I would like to conclude my remarks by saying that I firmly believe that United States farmers very definitely have the capability of meeting world food demands through exports and thus benefit not only themselves but the entire U.S. and the world economy. In order to do this, we will have to: 1) accept the fact that trade is trade and eliminate the word "foreign"; 2) identify our markets and produce what they want; 3) produce a quality product; 4) provide credit for our customers; 5) aggressively seek ways to optimize our production capabilities and the conservation of our natural resources; 6) clearly identify and promote a national export policy coordinated with both the government and the private sector; 7) redouble our efforts to preserve and promote the free-enterprise private sector.

As I look back over the history of our civilization, it occurs to me that we have gone through several eras where nations have sought supremacy in order to assure their longevity. During the early years of our civilization, the major concern was to control land masses. Then we saw the development of large flotillas of naval vessels to control the seas. The advent of the airplane shifted our sights ultimately to fighter planes, high altitude bombers, and ultimately, space ships. More recently, the concerns of nations around the world have focused on energy.

It now appears to me that the focus of world leaders and their nations for the future is also on food. There is no question in the minds of most world

leaders that the United States will play a vital role in the balance of world peace and prosperity as we attempt to decide our role in meeting world food demands through exports. The bottom line on whether or not we will be successful in this effort, in my opinion, depends upon whether or not we allow farmers to be full partners in this effort, and continue to allow them the opportunity to produce food and fiber under a system that truly must be considered one of our modern-day miracles; or whether we decide instead to remold this system for some apparently altruistic objective and, in the process, create a mediocre and inefficient system that can barely satisfy our own needs. This is the challenge.

Thank you very much for the opportunity to be with you. I hope that my comments have been useful and that they will help in some small way to focus our attention on the priorities we need to address if we are to help meet the food demands of a hungry world.

Meeting World Food Demands through Exports

Benefits to the American Economy

Wayne E. Swegle

We all know that agricultural exports are the one bright spot in our export picture and the main contributor to our national balance of payments. Without exports of agricultural products our balance of payments would be a disaster, rather than simply a matter of national concern.

This perception is not new. What is new is the growing realization among leaders of labor and industry and in government that exporting raw grains and other unprocessed agricultural products does not fully exploit this nation's capacity to add value to these commodities. Adding value through processing agricultural commodities would mean more jobs in this country. Creating jobs is a real and growing concern of labor. Right now we are exporting those jobs and that labor, as wheat is milled into flour overseas, as soybeans are processed into oil and meal in foreign countries, and so on.

Also exported are jobs in bag manufacturing, in producing additives, in the transportation, handling, and other steps involved in processing raw agricultural commodities into a more finished form. We are also exporting the profits, the taxes on the labor and profits, and the multiplier effect of the increased economic activity involved.

The economic effects of further processing of agricultural products in the United States would be considerable. If even 10 percent of the wheat we now export were exported in the form of flour produced from that wheat, it would create up to \$5.635 billion more business activity in this country. This processing would provide an additional 122,400 jobs. It would increase personal income in this country by as much as \$1.217 billion.

Similar economic effects of further processing in this country would apply to corn, soybeans, and other farm commodities now being exported primarily as raw materials.

The U.S. exported \$5.9 billion worth of soybeans in 1980. If we could have exported only 10 percent of those soybeans in the form of processed products, business activity would have expanded by \$2.646 billion, 28,320 more jobs would have been created, and personal income would have risen by \$253.7 million.

These data are taken from a study and publication done by Gerald Schluter and Kenneth C. Clayton, of the National Economics Division, Economics Research

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Service of the United States Department of Agriculture (USDA). The publication is titled, "Expanding the Processed Product Share of U.S. Agricultural Exports," Staff Report No. AGESS810701.

How does this multiplier effect work? In highly specialized economies, such as the United States, Japan, and the European Community, there are several stages involved in production from the raw material to the product which goes to the ultimate consumer. Numerous industries sell the majority of their output to other industries, rather than to the final market. This intermediate demand represents a sizable portion of total economic activity. In the U.S., inter-industry transactions represent more than 50 percent of the total dollar value transactions.

Thus, activity in one industry may depend heavily upon activities of other industries. Like ripples from a stone thrown in a pond, representing primary demand, the secondary demands ripple out through the U.S. economy, creating economic activity, jobs, and tax revenue for the government. The more processing of raw materials into finished or semi-finished goods which is done in this country, the more the economic benefit derived therefrom, and the stronger our nation's industrial and technological base remains.

When raw materials are processed into finished goods overseas, the economic benefits of that processing are lost to our economy. That loss is disproportionately greater because the economic stimulus of processing is much greater than that created by growing and transporting the raw material.

No nation better recognizes the economic benefits which accrue from processing raw materials into finished goods and selling them on world markets than Japan. As a result, Japan enjoys a very favorable balance of payments with the U.S. Consequently, Japan's growth rate exceeds ours and unemployment there is much lower. Japan must import 99.8 percent of its oil and most of the raw materials required to produce its finished goods. In spite of these drawbacks, the Japanese are prosperous because they pursue and capture world markets for goods with added-value, processed, and manufactured products, and with a single-minded, concerted effort of all their institutions--industrial, social, financial, and political.

Other industrial nations also have been alert to the necessity of creating sound economic growth by encouraging the export of processed and manufactured products instead of, or in addition to, raw materials. They process their own or imported raw materials into products of additional value for export, so they can generate greater business activity within their own countries--again, creating fuller employment, higher personal incomes, and a broader base for government revenues.

The European Community (EC) is well aware of the benefits of exporting processed commodities. Take wheat flour, for instance. The EC gives huge subsidies on flour to enable its millers to undercut prices of U.S., Canadian, and Australian millers by large amounts. The EC has largely driven other countries' millers out of commercial export markets and have gained an inequitable share of flour exports around the world. They even ship large amounts of flour to Jamaica, at our back door, by subsidizing so as to undercut the U.S. price despite the transportation differential.

U.S. flour millers are not subsidized and thus have also been driven out of most commercial flour export markets. Again, this defeat has happened because the EC

recognizes that the benefits to its economy are so great that they can continue to pay large subsidies and thus continue to dominate world flour markets.

Let us turn now to the trade policy aspects of exporting processed agricultural products. A variety of tariff and nontariff barriers confront agricultural exports in almost all countries in the world. And additional barriers exist for processed products. These barriers to trade are normally the result of national agricultural policies--that is, trade policies are usually secondary to agricultural policies; trade is, in part, determined politically in view of national production and related farm policies.

Therefore, the international market for U.S. agricultural products depends not only on economic growth but also on agricultural policies abroad. This fact applies in even greater degree to processed agricultural exports.

The agricultural sector in developed countries like the European Community generally receives substantial price protection; the result is both overproduction and underconsumption of agricultural output. In developing countries, this sector frequently finds cheap food policies which result in low farm prices and thus low agricultural output.

The European Community's common agricultural policy (CAP) is based on a system of high support prices, with variable levies applied to imports to bring the world price up to the threshold price at which imported agricultural commodities enter that market. By this mechanism, price competition by more efficient foreign suppliers, such as the U.S., is prevented. For example, the recent levy on wheat flour was about \$110 per metric ton, which amounts to a duty of almost 50 percent on U.S. wheat flour exports. Therefore, we cannot export flour to Europe.

In some instances the CAP threshold price is maintained by government purchases in the domestic market of the EC member states. In such cases, including wheat and some milk products, export subsidies financed by import levies and EC treasury funds are used to dump the products on world markets or divert them to inferior uses. Again, in the case of flour, the subsidized EC wheat flour exports are limiting U.S. exports of the same processed product.

Japan has a modern, highly developed agricultural industry and is the largest single market for U.S. agricultural exports. Yet, because of its fear of commodity price changes and a desire to protect inefficient domestic production, a basic tenet of its agricultural policy is to achieve excessive levels of self-sufficiency. Japan's agricultural output is maintained at a high level by high price supports, input subsidies, and controlled foreign trade, so that domestic prices of certain food items in Japan are double or three times those prevailing in world markets.

U.S. beef producers are eager to gain access to the Japanese market. The Japanese would consume substantially more U.S. and Australian beef if their government would allow them to do so. For rice, support prices paid to farmers by the Japanese government are equivalent to approximately twice world price levels. As a result, rice production exceeds consumption, so the government has to stockpile the surplus, divert it to feed, or export it at subsidized rates. Japan has dumped about 50,000 tons of rice abroad in each of the past two years. That's a substantial amount, given that world demand is inelastic and total world trade amounts to less than 8 million tons.

The domestic agricultural policies of the EC and Japan and their international trade implications have been detailed in order to illustrate the complex of problems which must be confronted in trying to expand processed U.S. agricultural commodity exports. Our ability to expand significantly our processed agricultural exports to those markets depends upon reforms of their domestic agricultural policies. The only exception would be for products which these countries do not produce domestically and for which there are no domestic substitutes available.

When we look to markets in the Soviet Union and in the Central European countries under Soviet influence, we find access controlled by government policies--both theirs and ours. Teams of flour millers and soybean processors have been to the Soviet Union in recent months, visiting with officials about their importing processed products. The reception was not altogether negative. But we now have what some regard as a de facto embargo, and these contacts have come to a halt. It is hoped that if there is another long-term agreement with the Soviets, there will be a provision for the inclusion of processed agricultural products such as wheat flour, corn gluten feed, and soybean meal and oil.

The major constraint to exporting to most of the developing countries, outside of various trade barriers, is their inability to finance imports. For the poorest countries, therefore, we would need to expand the amount of processed products programmed under Public Law 480. For the more advanced of these countries, more processed products could be supported by USDA's Commodity Credit Corporation and other credit programs.

With respect to commercial markets in the developing world in Southeast Asia, Latin America, Africa, and the Middle East, we must continue to try to halve the displacement of U.S. exports by subsidized exports from the EC or Japan, especially of processed agricultural products.

We have seen that there are benefits to the American economy in maximizing processed and added-value product exports in meeting world food demands. We also have looked at some of the constraints. There are some actions which can be taken to take advantage of the opportunities which lie ahead. Here are five suggestions:

1. We can increase the amount of processed agricultural products in any bilateral grain agreements negotiated on a government-to-government basis.
2. We should expand the amount of processed commodities which are shipped under Public Law 480 and similar aid programs to other nations.
3. We must obtain changes in the government policies of our trading partners, which now are severely limiting the export of U.S. agricultural products.
4. We need to take effective measures to halt the dumping and subsidy practices of the exporters of processed agricultural products to third country markets where such dumping and subsidization unfairly restrict U.S. exports.
5. We need to review the export marketing programs of the Foreign Agricultural Service of USDA to establish whether sufficient attention is being given to processed as well as raw agricultural products.

Increasing Food Production in Developing Countries with Purchased Inputs

The Problems and Opportunities of Technology Transfer

Roy E. Harrington

For decades the American farmer has been spending over half the value of his farm production on purchased inputs. This practice has been possible because over half of his production has been sold off the farm for an even greater period of time. Until recently most farmers in developing nations were outside the market economy, neither buying farm inputs nor selling farm production.

THE NEED FOR INCREASING FOOD PRODUCTION IN DEVELOPING COUNTRIES

Total food production in the developing nations has risen more in the past ten years than in the developed nations. However, food production per capita only improved one percent in the developing nations, while it improved 13 percent in the developed nations.[1] The rapid population increase in most developing nations makes it mandatory that they continue increasing their food production at a rate greater than is essential for the developed nations.

The U.S. provides over half of all grain traded in the world market, and thus exports are very important to the American farmer. However, less than 15 percent of all grain crosses national borders, and most of this flows between developed nations.[2,3] The author estimates that over 80 percent of all food consumed in developing nations is eaten within ten miles of where it was produced.[4] This fact will continue to be true for the foreseeable future because the per capita income in the developing countries is less than ten percent of that of the developed countries, resulting in the inability of the farmer to pay for much imported food.

This increased production must come through higher yields, especially in Asia, where 83 percent of all potential crop land is already in use.[5] While many have sought single, simple solutions to increasing crop production, those who have participated in such research generally recognize the following four requisites:

1. An improved farming system must be based on a combination of materials and practices which result in more farm profit at a reasonable level of risk.
2. Improved practices must be demonstrated to the farmer within walking distance of his village.

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3. Purchased inputs, and in many instances credit, must be available to the farmer when and where he needs them and at a reasonable cost.
4. Farmers must have nearby markets which consistently provide incentive prices.[5]

Four geographic areas were selected for the remainder of this paper to illustrate progress in agriculture. The United States was chosen as the basis for comparison in that it is familiar to more people. The time scale for the U.S. was shifted 20 years to the right, relative to the other locations, because the U.S. started major technological changes in farming at least two decades before such changes began in the developing nations. This continuation of the U.S. data across the graph also provides some indication of the results we might expect from developing nations in the next two decades. The largest geographic area chosen for comparison was the developing market economies. (It was necessary to leave out the planned economy of China because comparable data was not available over the entire period of 1960 to 1980.) The third geographic area chosen was India, because in the mid-Sixties it was the largest recipient of food aid in history. The state of Punjab in India was chosen as the fourth geographic area as it is in the heart of the Green Revolution and represents a more homogeneous area than the two larger ones. Yet its population of over 16,000,000 is larger than that of many developing nations so it provides a sufficiently large sample size to study.[6] Its population is greater than the state of Illinois and it has more people living on farms than does the United States.

IMPROVED VARIETIES OF CROPS

The starting point for any major change in agriculture is improved varieties of crops. In the United States, hybrid corn in the mid-Thirties led the parade of succeeding technological changes. For the developing nations, dwarf wheat and rice started the Green Revolution in the Sixties (see Figure 1). Note that the adoption of new wheat varieties took place more rapidly in India, and especially in Punjab, than the adoption rate of hybrid corn in the United States.[5,6,7,8,9]

While India's adoption rate of improved wheat is over 80 percent, it is only about 40 percent for rice and less than 30 percent for corn.[11] This adoption rate generally parallels the relative benefit to the farmer of these three important crops. The new wheat varieties provide some increase in yield with no other change in farming practices. With a reasonable amount of fertilizer applied, yields are easily doubled. The new wheat varieties have not had any unique problems with pests. While the new rice varieties have similar potential for yield increases, they require considerably greater farm management skills and effort. The highest yields of rice are obtained in well-fertilized, properly irrigated fields, which also result in an environment ideal for the development of additional weeds, insects, and diseases.

FERTILIZER

Figure 2 shows the slope of increasing fertilizer use for the developing nations and India to generally parallel the U.S. in its early period. However, Punjab has a slope at least double that for the U.S. and is already

using more fertilizer per hectare.[6,8,10,11,19] In most situations, fertilizer has the best return on investment of any purchased input. In a series of over 2,000 tests in India, at normal application rates, a ton of nitrogen resulted in an increase of ten tons of wheat with the new varieties. Slightly better results were obtained as an average for 1,400 tests with irrigated IR-8 rice. For both wheat and rice, the return on investment for fertilizer at normal rates is better than two to one. While we are inclined to think that the U.S. leads in all areas of farming, Japan and seven European nations consume more fertilizer per hectare than we do.[12]

Fertilizer use in India is a good example of how many obstacles can be overcome if a new practice makes overwhelming economic sense. The early fertilizer factories used past technology and did not produce fertilizer in a granular form. Fertilizer was lumpy or mushy and difficult to distribute either by machine or by hand. Most fertilizer in India is spread manually. Some fertilizer, as well as purchased seed, is adulterated in the distribution chain.[12] While most fertilizer produced in India is shipped in moisture-proof bags, they frequently arrive at the farm with one or more holes pierced by bale hooks used in manual handling. The result is both fertilizer leaks and the entrance of moisture.[13]

There remain many unknowns in the best technology for fertilizing rice, the developing nations' major crop. Rice is a minor crop in the U.S. and Europe, where fertilizer has been widely studied. Saturated soils, found in flooded paddy, further compound the unknowns.

India would like the economies in shipping of anhydrous ammonia, but it is not practical in the absence of pressurized tank cars, trucks, and farm fertilizer distributors. There is probably little need in India for the liquid fertilizers we use, as their main advantage is in reduced handling labor on the farm.

PLANT PROTECTION

Although Figure 3 compares pesticide use in the U.S. with that of India, there are many reasons for this comparison having less meaning than that for fertilizer.[11,14,15,16,17] Not only do pesticides include herbicides, insecticides, and fungicides, but there are a variety of compounds within each of them. Further, the need for pesticides varies significantly by crop pest and location. Herbicides account for over half of all dollars spent for pesticides in the U.S. but are of limited consequence in India, where in many cases hand-weeding makes more economic sense. Insecticides are used primarily on corn and cotton in the U.S., but mainly on rice in India. Another reason for lower adoption rates of pesticides in India has to do with both equipment costs and hazards to the applying operator. However, insecticides and herbicides will become increasingly important in the developing nations as rice production increases.

India and some other developing nations should be using malathion to protect stored grain from insects, but have been reluctant to do so because of adverse publicity about chemicals in the U.S.

IRRIGATION

Figure 4 indicates both a higher usage of irrigation and a higher rate of increase in irrigation for India and Punjab than in the United States.[1,8,11,20] Much of Asia depends on monsoon rainfall and so has little rain during the wheat-growing season and the winter rice season. Thus, generally speaking, irrigation permits doubling of crop yields. In many areas it also makes the growing of more than one crop (called multiple cropping) practical. Normally, irrigation has a very high return on investment, just as fertilizer does.

In 1960, government canals were the prime source of irrigation for India and Punjab. At the present time, 3-10 horsepower electric or diesel pumpsets provide over half of all irrigation in both India and Punjab. There are now more than eight million pumpsets in use on Indian farms, with about an equal division between electric and diesel units.[11,20] There has been a tenfold increase in each of these types of pumpsets in the past 15 years, or a compound annual growth rate of about 18 percent. The electric motors and diesel engines (without pumps or wells) have cost Indian farmers three times what they paid for tractors, but they have four times as much total power.[12,18]

Irrigation has not been without its troubles in India. Many government canals and management systems were designed to provide survival of crops rather than vigorous growth for high yields. To overcome this problem, the farmers purchased their own pumpsets. However, they still find themselves at the mercy of the government, since diesel fuel is rationed and electricity is frequently turned off in the daytime for farmers, and in some instances for full 24-hour periods.

MECHANIZATION

Figure 5 indicates that the use of tractors in the United States has leveled off, while in Punjab it now equals the U.S. and is still rapidly rising. [1,7,8,20,21,25] Although the total number of tractors in the U.S. has leveled off at something more than one tractor per worker, the total horsepower available on American farms continues to rise. While Punjab has about the same number of tractors per hectare as the U.S., it has only about one-third as much horsepower per hectare due to the smaller size of tractors made and sold in India.

Note that the adoption rate of tractors in Punjab has increased recently. In the 1960s farmers generally recognized that it took at least 12 irrigated hectares to justify the ownership of a 30-horsepower tractor. At that time, Punjabi farmers seemed unwilling to cooperate sufficiently to make custom operation a practical reality. In the Seventies, custom operation became very popular and is responsible for the more rapid adoption of tractors in recent years. Only about three percent of India's farms (25 percent of India's farmland) are 12-hectare size or larger.[26] While the average farm size in India is 2.3 hectares, those of Punjab are only slightly larger, at 2.9 hectares. Not only will population pressures keep farm size small in most developing nations, but in Punjab there is a legal land ceiling of seven

hectares for farms capable of growing two irrigated crops, 11 hectares for farms capable of growing one irrigated crop, and 21 hectares for rainfed farms.[14]

In 1980 ten Indian manufacturers produced and shipped a total of over 63,000 tractors in 23 different models.[29,34] Most of these were in the 30-40 horsepower range and cost US\$6,000 to \$8,000. Since tractors were first produced in India in 1961, the demand has been such that tractor inventories have normally been under 20 percent of annual tractor sales. For the past 10 years, tractor sales have increased at an annual compound rate of 13 percent. In 1979 and 1980, India ranked fifth in tractor shipments behind only the U.S.S.R., the United States, China, and France in 1979 and Japan in 1980. The importance of tractors to the Indian economy is dramatically illustrated by the fact that in 1978 and later, tractor sales exceeded those of cars or trucks.[24] China also produces more tractors than cars or trucks.[22,23] Conversely, in the United States, cars outsell tractors by a factor of 50 to 1.

A Dutch collaboration started making tractor-mounted combines in Bangalore, India, in 1970 and has produced 1,070 of them in the past ten years.[14,34] About half that many large self-propelled combines have been imported, primarily from East Germany and West Germany. In 1981 a government concern started making and selling the Swaraj self-propelled combine. A few small Punjab manufacturers have also started copying the Viccon combine made in Bangalore.

Has the adoption of tractors been the result of higher crop production or the cause of higher crop production? The answer is yes to both questions. Tractors have rarely been the first change made by a traditional Indian farmer. Normally, he has adopted new varieties, fertilizer, and irrigation before having sufficient money to purchase a tractor. With the adoption of these three important inputs, he experiences a time constraint making it difficult for him to multiple-crop because it takes too much time to harvest one crop and then till the field for the succeeding crop. Thus, the justification for tractor ownership in most instances is to permit a farmer to multiple-crop successfully a larger share of his farm.

While tractors are becoming increasingly important in certain areas of the developing nations, as a whole people and animals still provide over two-thirds of all power on their farms.[4,12]

LABOR

A continuing decline in U.S. farm labor is shown in Figure 6.[1,8,27] While the number of hired farm workers in the U.S. has remained constant since 1967, the number of family farm workers has declined by about one million during this period. The developed market economies as a whole have experienced a three-percent annual decline in farm workers during the past 15 years.

The number of farm workers in the developing market economies, on the other hand, rose 1.2 percent per percent per year during the past 15 years. The

number of farm workers in the developing market economies actually rose each year by an amount greater than the current number of total farm workers in the United States.

The 1.2 percent annual increase in number of farm workers is almost half of the 2.6 percent annual increase in total population of the developing market economies. The supply of farm workers is expected to continue to increase for the foreseeable future as long as total population continues to increase.

India has a higher labor use per hectare than the rest of the developing market economies but has a similar growth rate. Punjab started at a lower level but has grown at an annual rate of two percent for the past 20 years.

CEREAL GRAIN YIELDS

Rice, wheat and corn are the main sources of food in the developing market economies.[1,8,11,26] Average rice yields in the U.S., as shown in Figure 7, are rather high because the limited number of farmers who grow rice developed their production technology during a time of tightly controlled acreage allotments. Yields in India and the developing market economies have increased relatively slowly in spite of the introduction of new varieties from the International Rice Research Institute. The new varieties need both higher farm management skills and more purchased inputs to achieve maximum production and profits. However, in India, government procurement prices for rice have been only about half the average price paid to American farmers in the period 1976 to 1979.

Rice yields in Punjab, however, have grown quite dramatically during this period, so that rice has become a very profitable crop. Rice is better suited to monsoon weather than the traditional corn and cotton, so rice has helped the Punjabi farmer increase his amount of multiple cropping. During the past ten years he has increased his area in wheat only 30 percent, while the area used for rice has risen over 200 percent and corn has declined slightly.

The dramatic increases in wheat yields and production in Punjab have been at the heart of most stories about the Green Revolution (see Figure 8). Punjab's wheat yields of 2.8 tons per hectare are double those for India and significantly above those for the U.S. and Kansas, our state with the highest production. One of the reasons that wheat yields have increased so rapidly in Punjab is that the farmer has consistently received incentive prices which were about 25 percent above U.S. levels in the years 1976-79.[5,11,27]

Corn is possibly America's highest technology crop, with yields more than tripling since 1940, as shown in Figure 9.[1,8,11] Unfortunately, even Punjab is on a plateau, with corn yields that are slightly lower than the U.S. had in 1940. Causal factors include the excess rainfall received during the monsoon season and the serious competition by grass and other weeds. Another reason is that improved varieties, well matched to India's climate, have not been developed as they have for rice and especially wheat. Also, farmers have consistently been unable to get quality seeds.[14]

The attempt to introduce hybrid corn has met with numerous special problems. The farmer finds it difficult to believe that a variety which is better than his old one is not good enough to let him save the seed to plant next year, as he does with his improved wheat or rice. Another problem is that the government is the source for most improved seeds; in most developing countries, it has not had the required skill or discipline to develop and multiply hybrid corn. Kenya is probably the only poor developing nation which has a flourishing hybrid seedcorn industry.[5]

When the yields of all cereal grains are combined as shown in Figure 10, Punjab still looks good compared to the rate of yield increase for the U.S. [1,8,11]

MULTIPLE CROPPING

Each region of the world has its own scarce, expensive resource, such as labor in the U.S. Americans visiting India are rather appalled to see employed but idle workers. India's scarce expensive resource is land, and thus they try to maximize its utilization. Indians, Chinese, and Europeans find it hard to comprehend why we waste so much land in and around our cities and along our highways.

Multiple cropping has received only moderate acceptance in the U.S., as shown in Figure 11.[8,20,28] The most commonly paired crops in the U.S. are soybeans and winter wheat. In India wheat is grown in the north and rice in the south during the winter. Rice, corn, cotton, sorghum, and peanuts are common summer crops. The temperature in India is sufficient to permit multiple cropping throughout most of the country. The primary limitations are having the correct amount of moisture and the timeliness of farm operations. The Punjabi farmer has secured adequate moisture by adopting tubewell irrigation with pumpsets. He has overcome the timeliness problem by either owning or hiring a tractor for his tillage and threshing.

Figure 11 gives some indication of the pressure on scarce land; it shows that 57 percent of the cropland in Punjab grows two or more crops per year. Even more dramatic is the fact that farmers in Punjab harvest crops each year on 130 percent of the total geographic area of the state.[8,27] This is double the use of our land in the most concentrated farming states of Iowa and Illinois, where we harvest crops on only 65 percent of the geographic area.

GRAIN TRADE BALANCE

Figure 12 shows a continual rise in U.S. grain exports since 1940 and a dramatic increase in the Seventies.[1,2,8,31,32,33] With the U.S. now supplying over half of all grain exports, these exports have become a major source of farm income and an important aid toward balancing oil imports. Grain exports did not start for the U.S. in 1940 but that just happened to be a very low year.

The developing market economies continue to be more and more dependent on grain imports. Nicaragua, Egypt, and Bangladesh all have a high ratio of imports to domestic grain production and each has difficulty in paying for the grain.

India imported over ten million tons of grain in 1966, but has progressed toward self-sufficiency since then. From 1978 on, it has been a minor net exporter of grain.[30,31] In fact, India has had a favorable total agricultural trade balance from 1970 to date for each year except 1975.[7]

Punjab is the star performer in grain exports.[8] Total grain production is currently about five times its value in 1960. Four factors contributed to this dramatic increase. The original area sown to grain in 1960 was increased 20 percent by increasing the net area sown for all crops. Another 28 percent was achieved by a shift from pulses to grain. Additional multiple cropping increased the grain area a further 64 percent. The biggest factor, however, was yield increases of 130 percent. Punjab now furnishes more grain to the rest of India than it received in exports from other countries in the hungry Sixties.

A good indicator of the economic health of a nation is the relative balance between what it sells versus what it buys. India's economy has obviously improved but it continues to be marginal. The economic health of the state of Punjab, especially that of its farmers, is quite high relative to the remainder of the country.

RESULTS OF CHANGE

Outside observers of the Green Revolution have shown considerable concern that the rich would get richer and the poor poorer as technological changes permitted the Punjabi farmer to enter the market economy. Some felt that only the large farmer would be able to adopt improved varieties, fertilizer, and irrigation. A study reported in 1971 compared the adoption rates of improved varieties among farms under five acres, those of 5-20 acres, and those of 20 acres and above. In the cases of both wheat in the Punjab and rice in Tamil Nadu the smaller farmers adopted the improved varieties as fast as did the average of all farmers.[36]

Numerous studies have shown that small farmers readily adopt fertilizer use because it is available in small quantities and generally returns two dollars within six months of the farmer's having invested one dollar. Irrigation requires a relatively high initial capital investment and requires a longer period to pay back. However, irrigation makes such overwhelming economic sense that it, too, has been widely adopted by small farmers.[11] There are now almost twice as many diesel and electric pumpsets in India as there are tractors in the United States. An all-India study indicates similar adoption rates of irrigation between farms under five acres and those over five acres.[36]

Because purchased inputs include tractors, the future of the hired farm laborer may appear doubtful. Numerous studies have shown that farm labor use increases when improved varieties of wheat or rice are adopted.[9,35] This increase can be readily explained, since the use of fertilizer and irrigation requires additional farm operations and higher yields require more labor for harvesting and threshing the crop. Other studies have shown that farm labor use continues to increase even with the adoption of tractors.[13,34] However, tractor use results in distinct decreases in the use of bullocks. The cause and effect of tractors on labor use is complex and not easily understood.

Tractors are normally purchased only after the adoption of other purchased inputs has resulted in a considerable increase in farm production and income. The direct way that tractors increase labor use is through the greater adoption of multiple cropping.

Many have questioned how much farm labor would continue to be used in Punjab in the presence of high tractor usage. Figure 6 shows a 48-percent increase in the number of farm workers in Punjab during the past 20 years. The number of farm workers in agriculture actually increased from 56 percent in 1961 to 59 percent in 1981.[6,8] While the number of farm workers continues to decline in almost all countries, employment opportunities actually improved for farm workers in Punjab during this time of rapid changes in agriculture.

Increased demand for farm labor has also resulted in higher farm wages.[8,13,26] Farm wages in Punjab rose from \$0.35 per day in 1961 to \$1.38 in 1980 in current prices, more than double the current average farm wage in India.[9] At constant prices, the overall per capita increase in real income in Punjab during this period is over 70 percent. This figure is based primarily on the increases in farm wages, because factory wages in Punjab continue below the national average and are only about 35 percent above farm wages.

Improved farm wages in Punjab follow the pattern that has been noted in other Asian countries. As Japan, Taiwan, and Korea mechanized, real farm wages at least doubled and are now above six kg of rice per day for farm labor.[37] Indian farm wages outside of Punjab are generally about two kg of rice per day.[9]

What are some of the personal benefits in Punjab of this higher standard of living? Obviously higher food production, higher employment, and higher wages mean that the masses eat better.[6,8] In the health field, there are now six times as many rural dispensaries as there were in 1970. Rural infant deaths have been cut in half since 1966.

While literacy is still rather low at 41 percent, the number of schools has increased by 73 percent in Punjab since 1969. All villages in Punjab are now electrified and over half of all homes have electricity. Home use of electricity in Punjab is the highest of any state and more than double the all-India average.

Since the length of roads is almost three times as great as a decade ago, ninety-seven percent of all Punjabi villages are now connected by roads. Annual registrations of new scooters and motorcycles is about five times as much as ten years ago. There are now two and one-half times as many radios as there were fifteen years ago and the number of television sets has tripled in the past three years.

Another concern over changes in agriculture is that most purchased inputs are based on commercial energy sources. In 1972 farm machinery used 51 percent of the worldwide energy inputs to agricultural production. About one-third of this energy was used in the manufacture and two-thirds for the operation of farm machinery. Fertilizer was next with 45 percent, most of which was used in the production of nitrogen. Irrigation and pesticides each required about two percent. By 1985 fertilizer is expected to amount to 56 percent,

with farm machinery down to 40 percent, and irrigation and pesticides remaining at two percent.[38] In 1972 North America used 28 percent of the energy expended in worldwide agriculture, while the developing market economies only used 12 percent. By 1985 the North American share is expected to be 22 percent, while that of the developing market economies is expected to rise to 21 percent. It is a bit difficult to say that we cannot share this much energy with them, when their population is more than eight times as great as ours. Fertilizer is expected to account for 70 percent of the energy used for the agricultural inputs of the developing market economies in 1985. Since the first increment of use of fertilizer is much more efficient than the last increment of use, surely such use of the world's resources is justified. These resources must be shared among all the nations.

WHY DOESN'T EVERYONE COPY PUNJAB?

In spite of what seems like an overwhelming, urgent need for poor countries to become self-sufficient in food, this goal will be delayed by many political, social, economic, and natural obstacles to change. Probably the foremost of these is the inability of governments to develop and pursue consistent policies focused on agricultural development. Dr. W. David Hopper has enumerated many political trade-offs, starting with the obvious decision between a policy of cheap food versus incentive farm prices.[5]

Many areas of India and elsewhere have both a climate and land which are not well suited to farming. Punjab has easy access to a seemingly endless supply of ground water for irrigation, water which may be reached within 30 feet of the surface without going through any rock.

It is much more difficult to put numbers on human resources than natural resources. Punjabi farmers appear to be less bound by tradition than most subsistence farmers, possibly due to mass resettlements during partition nearly 40 years ago. The Punjabi farmer is just as interested in planting his wheat in straight rows with his bullocks as our fathers were in planting corn in straight rows with horses. No one has established any significant yield increases for straight rows over crooked rows. However, the ever-present desire of the farmer to do his best does result in distinctly improved crop yields.

The research results on wheat at CIMMYT in Mexico and rice at IRRI in the Philippines fitted the Punjabi farmers' needs very well, as may be observed in Figures 7 and 8. However, it is equally obvious that the same farmers with the same land have little success at increasing corn yields. Much research remains to be done on factors such as additional crops, tropical soils, and semi-arid climates.

Education has not been as well tailored to the needs of the developing nations as research has been. Although the majority of today's students are studying in their home countries, many, if not most, of their professors received some or all of their training from an industrial nation, especially the U.S. We have never felt that we could afford classes or textbooks uniquely designed to match the needs of students from developing nations.

Farm practices change more rapidly when a good extension worker demonstrates new materials or practices in the farmer's own village. The extension worker

needs to be competent in technical areas, economics, farm operations, and communications.[5] These are a lot of qualifications to ask for the wages typically received by extension workers.

There remains much that the U.S. could and should be doing to help these developing nations. Probably most important is increased trade through reduced tariff and nontariff trade barriers. We want free trade for our grain exports but continue to limit the import of animal products and clothing. Trade provides the developing nations with greatly needed foreign exchange to buy technology for their development.

Technical assistance through the U.S. Agency for International Development, together with other assistance from the United States, has been instrumental in much of the technical progress which has been made to date by developing nations. However, the U.S. has fallen behind in relative terms and now gives less than half as much percentage of GNP in comparison to eight European countries, Australia, and Canada.[4] We also need to separate our economic and agricultural development aid from our political and military aid. We should continue to consider our own self-interest but in an enlightened way. Some of our best current importers of farm commodities, such as Japan, Taiwan, Korea, Turkey, and Brazil, are past recipients of development assistance. While it is difficult to say that we as a nation can afford more aid at this time, several comparisons in the 1980 "Report of the Presidential Commission on World Hunger" indicate that we should reconsider our priorities.[39] A particularly interesting comparison states, "In 1978, the people of the United States lost more money at the gambling tables in Nevada than we gave in our development assistance programs."

SUMMARY

The developing nations must increase their food production faster than the developed nations if they are to retain or regain self-sufficiency in food. For most farmers this must be done through increased yields from purchased inputs. Improved varieties, fertilizer, and irrigation have been the main contributors to increased food production to date. However, pesticides are becoming increasingly important in rice cultivation, and tractors have made major contributions to multiple cropping, thus further increasing the amount of food produced per hectare per year. The traditional input of labor continues to increase per hectare with improved technology, including tractors.

The adoption of these new purchased inputs and the resultant increases in grain yields are illustrated from 1940-80 for the U.S. and from 1960-80 for Punjab, India, and the developing market economies. Punjab is the star performer both in rate of change and total achievements. Punjab now exceeds the United States in per hectare use of fertilizer and irrigation, and now matches the U.S. in tractor use. As a result, Punjab wheat yields are higher than those in the U.S.

Consequently, Punjab has essentially replaced the U.S. as the main source of grain for the food-deficit states in India. Punjab's food exports have increased employment opportunities and pay for hired farm labor and have also increased the level of living for Punjab as a whole in terms of health, education, electricity, communication, and transportation.

FIGURE 1. IMPROVED VARIETIES

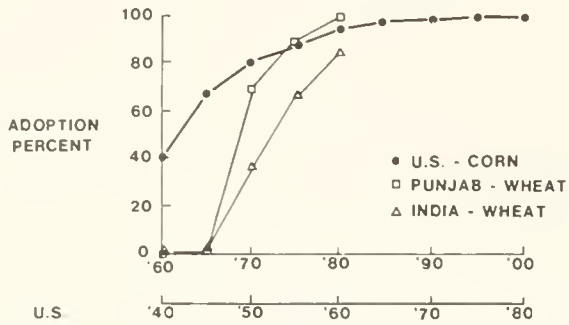


FIGURE 2. FERTILIZER USE

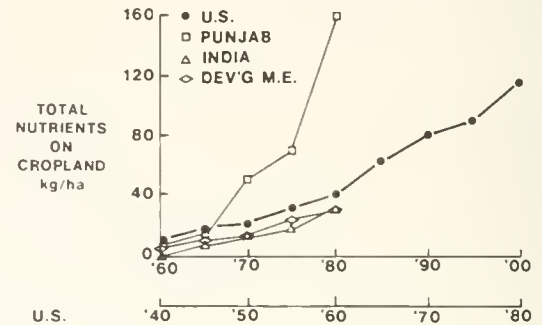


FIGURE 3. PLANT PROTECTION

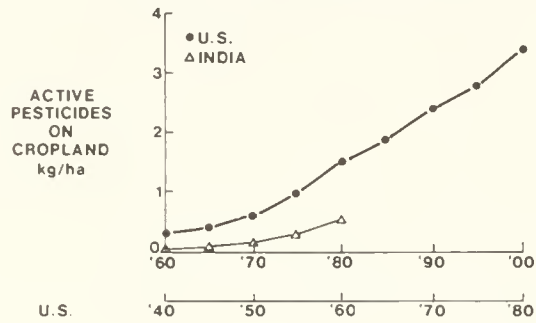


FIGURE 4. IRRIGATION

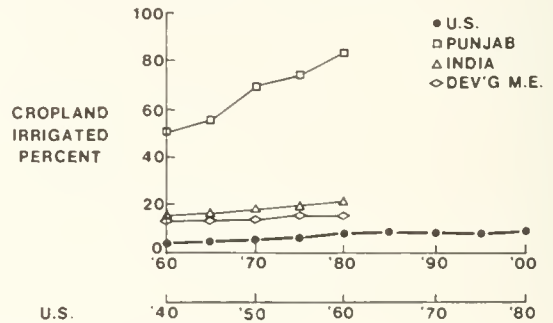


FIGURE 5. TRACTOR USE

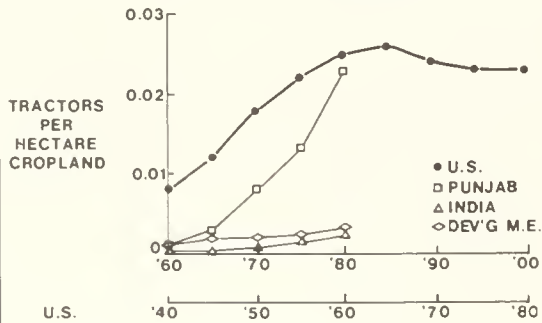


FIGURE 6. LABOR

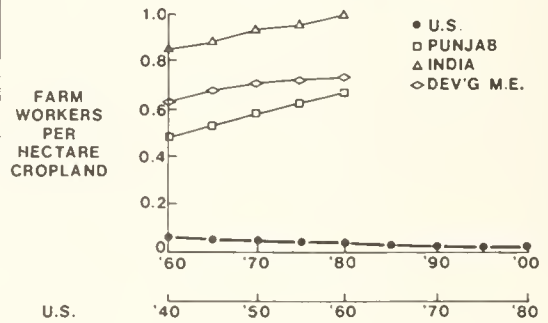


FIGURE 7. RICE YIELDS

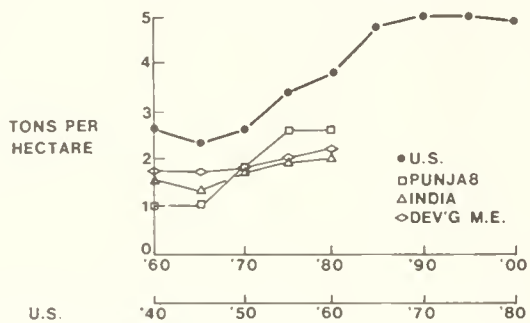


FIGURE 8. WHEAT YIELDS

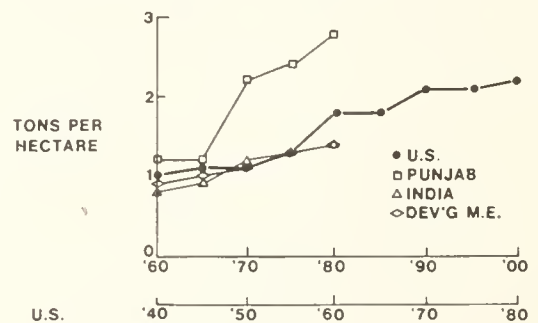


FIGURE 9. CORN YIELDS

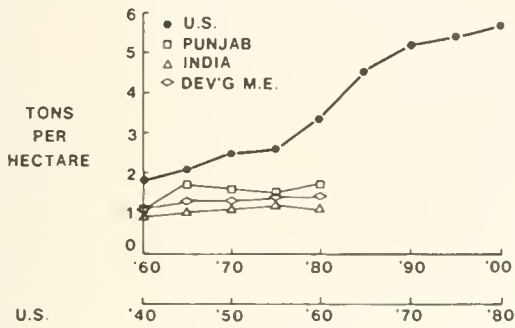


FIGURE 10. TOTAL CEREAL YIELDS

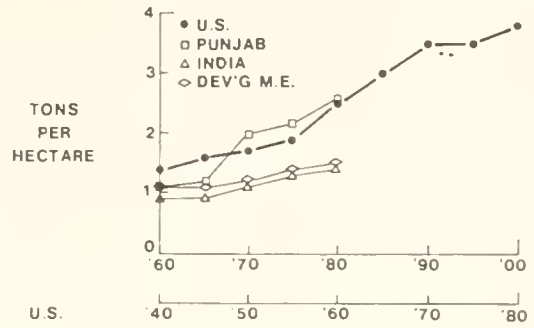


FIGURE 11. MULTIPLE CROPPING

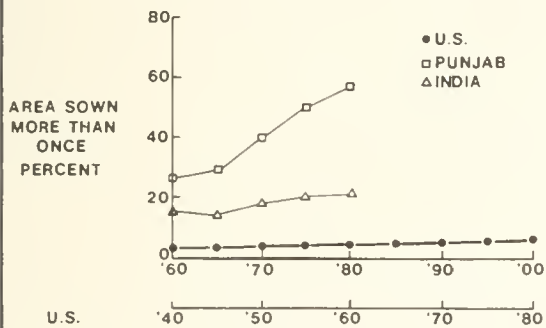
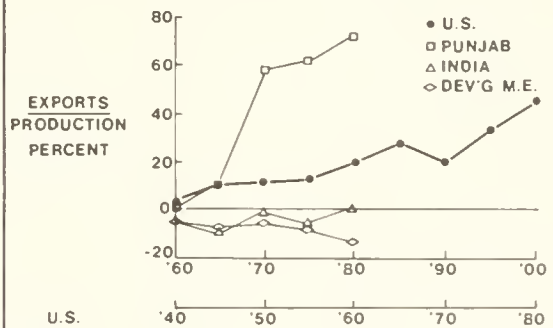


FIGURE 12. GRAIN TRADE



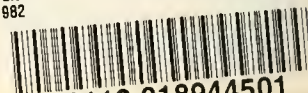
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